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## Interventions and Management

### **1. iMOVE: Intensive Mobility training with Variability and Error compared to conventional rehabilitation for young children with cerebral palsy: the protocol for a single blind randomized controlled trial.**

Prosser LA, Pierce SR, Dillingham TR, Bernbaum JC, Jawad AF.

BMC Pediatr. 2018 Oct 16;18(1):329. doi: 10.1186/s12887-018-1303-8.

**BACKGROUND:** Cerebral palsy (CP) is the most common cause of physical disability in children. The best opportunity to maximize lifelong independence is early in motor development when there is the most potential for neuroplastic change, but how best to optimize motor ability during this narrow window remains unknown. We have systematically developed and pilot-tested a novel intervention that incorporates overlapping principles of neurorehabilitation and infant motor learning in a context that promotes upright mobility skill and postural control development. The treatment, called iMOVE therapy, was designed to allow young children with CP to self-initiate motor learning experiences similar to their typically developing peers. This manuscript describes the protocol for a subsequent clinical trial to test the efficacy of iMOVE therapy compared to conventional therapy on gross motor development and other secondary outcomes in young children with CP. **METHODS:** The study is a single-blind randomized controlled trial. Forty-two participants with CP or suspected CP between the ages of 1-3 years will be randomized to receive either the iMOVE or conventional therapy group. Distinguishing characteristics of each group are detailed. Repeated measures of gross motor function will be collected throughout the 12-24 week intervention phase and at three follow-up points over one year post therapy. Secondary outcomes include measures of postural control, physical activity, participation and caregiver satisfaction. **DISCUSSION:** This clinical trial will add to a small, but growing, body of literature on early interventions to optimize the development of motor control in young children with CP. The information learned will inform clinical practice of early treatment strategies and may contribute to improving the trajectory of motor development and reducing lifelong physical disability in individuals with CP. **TRIAL REGISTRATION:** ClinicalTrials.gov identifier NCT02340026 . Registered January 16, 2015.

PMID: [30326883](#)

### **2. Head and Trunk Movements During Turning Gait in Children with Cerebral Palsy.**

Bartonek A, Lidbeck C, Hellgren K, Gutierrez-Farewik E.

J Mot Behav. 2018 Oct 16:1-9. doi: 10.1080/00222895.2018.1485009. [Epub ahead of print]

Thirty children with cerebral palsy (CP) and 22 typical developing (TD) were tested with 3D-gait analysis. At turning, trunk rotation was larger in CP2 (GMFCS II) than in TD and CP1 (GMFCS I), and head flexion was larger in CP3 (GMFCS III) than TD. Maximum head and trunk flexion values during the entire trial were larger in CP3 than in the other groups, and trunk flexion was larger in CP2 than in TD. Trial time increased with GMFCS-level. Less trunk rotation than TD and CP1 reflects spatial insecurity in CP2, which in CP3 is compensated by the walker. The flexed head and trunk in CP3 and trunk in CP2

may reflect deficits in proprioception and sensation requiring visual control of the lower limbs.

PMID: [30325711](#)

### **3. Interobserver reliability in the interpretation of three-dimensional gait analysis in children with gait disorders.**

Wang KK, Stout JL, Ries AJ, Novacheck TF.

Dev Med Child Neurol. 2018 Oct 15. doi: 10.1111/dmcn.14051. [Epub ahead of print]

**AIM:** To assess interobserver reliability in the interpretation of three-dimensional gait analysis (3DGA) of children with gait disorders within a single institution. **METHOD:** Seven experienced interpreters in our institution participated in a quality-assurance program reviewing one unique patient's 3DGA data every 3 months. Between 2014 and 2017, 15 patients' data were interpreted (14 with spastic cerebral palsy, 1 with myelodysplasia). Interpreters were asked to select 'yes', 'no', or 'indeterminate' from a list of problems and treatment recommendations. Kappa and percent agreement calculations were performed to evaluate consistency. **RESULTS:** Average percentage agreement in problem identification and treatment recommendation was greater than 84 percent and 90 percent for all interpreters respectively. Average kappa for the 10 most consistently identified problems and recommended treatments were 0.69 and 0.59 respectively. Interpreter consistency was moderate or better for the most commonly performed operations at our institution (0.44-0.59). Sagittal plane abnormalities of the hip and knee had the highest consistency. **INTERPRETATION:** When institutional differences in data collection and regional variations in management philosophies are removed, interobserver consistency in 3DGA interpretation is moderate to substantial for many commonly selected items. Identification of areas with poor consistency may help address underlying causes and improve data processes. **WHAT THIS PAPER ADDS:** Consistency in three-dimensional gait analysis interpretation and treatment recommendation is high within a single institution. There is moderate or better consistency for most commonly identified problems and recommended treatments. Sagittal plane problem identification of the hip and knee have the highest consistency. Lower consistency is seen in areas with poor objective measures, such as dystonia and balance.

PMID: [30320435](#)

### **4. Trunk Kinematic Analysis during Gait in Cerebral Palsy Children with Crouch Gait Pattern.**

Abbasi L, Rojhani-Shirazi Z, Razeghi M, Raeisi Shahraki H.

J Biomed Phys Eng. 2018 Sep 1;8(3):281-288. eCollection 2018 Sep.

**BACKGROUND:** Deficits in upper body movement have received little attention during gait in cerebral palsy (CP) children with crouch gait pattern (CGP). **OBJECTIVE:** Purpose of this research is to describe the correlation of trunk movement with the excessive knee flexion and ankle kinematic in CP children with CGP. **MATERIAL AND METHODS:** Gait analysis data from 57 limbs of diplegic CP children with CGP and 26 limbs of normal children was gathered. Kinematic parameters of trunk in relation to the pelvis were extracted in the sagittal, transverse and coronal planes. CP limbs were clustered using K-means cluster analysis according to the knee flexion angle at initial contact and the mean position of ankle joint during the stance phase of gait cycle, to three clusters. Pearson correlation coefficient between knee, ankle and trunk kinematic variables was assessed. Differences between clusters were analyzed with Kruskal-Wallis and post hoc tests. **RESULTS:** The results revealed: 1) crouch clusters had more trunk obliquity and rotation mean position than normal; 2) the range of motions of the trunk obliquity and rotation exhibited significant differences between crouch and normal clusters; 3) the level of excessive knee flexion had positive correlation with the trunk mean position in all planes; 4) the ankle kinematic at stance phase was associated with the trunk mean position in all planes. **CONCLUSION:** The results revealed the trunk mean position is correlated with the excessive knee flexion severity and ankle joint kinematic in CP children with CGP.

PMID: [30320032](#)

### **5. Use of iliac crest allograft for Dega pelvic osteotomy in patients with cerebral palsy.**

Sung KH, Kwon SS, Chung CY, Lee KM, Kim J, Park MS.

BMC Musculoskelet Disord. 2018 Oct 16;19(1):375. doi: 10.1186/s12891-018-2293-2.

**BACKGROUND:** Dega pelvic osteotomy is commonly performed procedure in patients with cerebral palsy (CP) undergoing

hip reconstructive surgery for hip displacement. However, there has been no study investigating the outcomes after Dega pelvic osteotomy using allograft in patients with CP. This study investigated the outcomes of Dega pelvic osteotomy using iliac crest allograft in CP with hip displacement and the factors affecting allograft incorporation. **METHODS:** This study included 110 patients (150 hips; mean age 8y7mo; 68 males, 42 females) who underwent hip reconstructive surgeries including Dega pelvic osteotomy using iliac crest allograft. To evaluate the time of allograft incorporation, Goldberg score was evaluated according to the follow-up period on all postoperative hip radiographs. The acetabular index, migration percentage, and neck-shaft angle were also measured on the preoperative and postoperative follow-up radiographs. **RESULTS:** The mean estimated time for allograft incorporation (Goldberg score  $\geq 6$ ) was 1.1 years postoperatively. All hips showed radiographic union at the final follow-up and there was no case of graft-related complications. Patients with Gross Motor Function Classification System (GMFCS) level V had 6.9 times higher risk of radiographic delayed union than those with GMFCS level III and IV. Acetabular index did not increase during the follow-up period ( $p = 0.316$ ). **CONCLUSIONS:** Dega pelvic osteotomy using iliac crest allograft was effective in correcting acetabular dysplasia, without graft-related complications in patients with CP. Furthermore, the correction of acetabular dysplasia remained stable during the follow-up period.

PMID: [30326877](#)

## 6. Pelvic obliquity and measurement of hip displacement in children with cerebral palsy.

Hägglund G, Goldring M, Hermanson M, Rodby-Bousquet E.

Acta Orthop. 2018 Oct 17;1-4. doi: 10.1080/17453674.2018.1519104. [Epub ahead of print]

**Background and purpose** - Pelvic obliquity, common in individuals with cerebral palsy (CP), changes the muscle force vector on the hip joint and probably affects the risk of hip dislocation. We evaluated a new method for measurement of hip displacement in CP that takes the pelvic obliquity into account: the pelvic adjusted migration percentage (PAMP). **Children and methods** - From the Swedish surveillance program for cerebral palsy (CPUP), the first pelvic radiograph of 268 children <18 years in southern Sweden during a 3-year period were evaluated. Pelvic obliquity, PAMP, and the migration percentage (MP) were measured. 50 radiographs were randomly selected for analysis of interrater reliability by three raters using the intraclass correlation coefficient (ICC). The correlations between PAMP/MP and pelvic obliquity were analyzed with Pearson correlation coefficients. **Results** - The interrater reliability for all 3 measurements was high (ICCs 0.88-0.97). The correlation between the high side of the pelvic obliquity and the difference between right and left hip displacement was higher for PAMP ( $r = 0.70$ ) than for MP ( $r = 0.41$ ). **Interpretation** - The new PAMP measurement showed high interrater reliability and a higher correlation with pelvic obliquity than MP. We suggest the use of PAMP at least in hips with a pelvic obliquity exceeding  $5^\circ$ .

PMID: [30326758](#)

## 7. Outcomes of salvage hip surgery in children with cerebral palsy.

Chan P, Hsu A, Godfrey J, Silva SS, Goldstein RY, Ryan D, Choi PD, Kay RM.

J Pediatr Orthop B. 2018 Oct 15. doi: 10.1097/BPB.0000000000000566. [Epub ahead of print]

This study compared the outcomes of four salvage procedures in treating painful dislocated hips in patients with cerebral palsy: Schanz osteotomy, Girdlestone, Castle, and McHale procedures. A retrospective review of cerebral palsy patients treated between 1990 and 2014 with minimum 6-month follow-up was carried out. Of 69 hips (62 patients), there were 36 McHales, 24 Castles, four Girdlestons, and five Schanz procedures at a mean age of 13.9 years. All four procedures provided pain relief. Proximal femoral migration was similar following the procedures, but heterotopic ossification was more common after the Castle procedure. Bone resorption and revision surgery were more frequent after the McHale procedure.

PMID: [30325788](#)

## 8. The Relationship Between Medial Gastrocnemius Lengthening Properties and Stretch Reflexes in Cerebral Palsy.

Bar-On L, Kalkman BM, Cenni F, Schless SH, Molenaers G, Maganaris CN, Bass A, Holmes G, Barton GJ, O'Brien TD, Desloovere K.

Front Pediatr. 2018 Oct 4;6:259. doi: 10.3389/fped.2018.00259. eCollection 2018.

Stretch reflex hyperactivity in the gastrocnemius of children with spastic cerebral palsy (CP) is commonly evaluated by

passively rotating the ankle joint into dorsiflexion at different velocities, such as applied in conventional clinical spasticity assessments. However, surface electromyography (sEMG) collected from the medial gastrocnemius (MG) during such examination reveals unexplained heterogeneity in muscle activation between patients. Recent literature also highlights altered muscle tensile behavior in children with spastic CP. We aimed to document MG muscle and tendon lengthening during passive ankle motion at slow and fast velocity and explore its interdependence with the elicited hyperactive stretch reflex. The ankle of 15 children with CP (11 ± 3 years, GMFCS 9I 6II, 8 bilateral, 7 unilateral) and 16 typically developing children (TDC) was passively rotated over its full range of motion at slow and fast velocity. Ultrasound, synchronized with motion-analysis, was used to track the movement of the MG muscle-tendon junction and extract the relative lengthening of muscle and tendon during joint rotation. Simultaneously, MG sEMG was measured. Outcome parameters included the angular and muscle lengthening velocities 30 ms before EMG onset and the gain in root mean square EMG during stretch, as a measure of stretch reflex activity. Compared to slow rotation, the muscle lengthened less and stretch reflex activity was higher during fast rotation. These velocity-induced changes were more marked in CP compared to TDC. In the CP group, muscle-lengthening velocity had higher correlation coefficients with stretch reflex hyperactivity than joint angular velocity. Muscles with greater relative muscle lengthening during slow rotation had earlier and stronger stretch reflexes during fast rotation. These initial results suggest that ankle angular velocity is not representative of MG muscle lengthening velocity and is less related to stretch reflex hyperactivity than MG muscle lengthening. In addition, muscles that lengthened more during slow joint rotation were more likely to show a velocity-dependent stretch reflex. This interdependence of muscle lengthening and stretch reflexes may be important to consider when administering treatment. However, muscle and tendon lengthening properties alone could not fully explain the variability in stretch reflexes, indicating that other factors should also be investigated.

PMID: [30338247](#)

### **9. Medial gastrocnemius volume and echo-intensity after botulinum neurotoxin A interventions in children with spastic cerebral palsy.**

Schless SH, Cenni F, Bar-On L, Hanssen B, Kalkman B, O'brien T, Aertbeliën E, Van Campenhout A, Molenaers G, Desloovere K.

Dev Med Child Neurol. 2018 Oct 15. doi: 10.1111/dmcn.14056. [Epub ahead of print]

**AIM:** This cross-sectional investigation evaluated whether recurrent botulinum neurotoxin A (BoNT-A) interventions to the medial gastrocnemius have an influence on muscle morphology, beyond Gross Motor Function Classification System (GMFCS) level. **METHOD:** A cohort of typically developing children (n=67; 43 males, 24 females; median age 9y 11mo [range 7y 10mo-11y 6mo]), a cohort of children with spastic cerebral palsy (CP) naive to BoNT-A interventions (No-BoNT-A; n=19; 10 males, nine females; median age 9y 3mo [range 8y 5mo-10y 10mo]) and a cohort of children with spastic CP with a minimum of three recurrent BoNT-A interventions to the medial gastrocnemius (BoNT-A; n=19; 13 males, six females; median age 9y 8mo [range 7y 3mo-10y 7mo]) were recruited. Three-dimensional freehand ultrasound was used to estimate medial gastrocnemius volume normalized to body mass and echo-intensity. **RESULTS:** Normalized medial gastrocnemius volume and echo-intensity significantly differed between the two spastic CP cohorts ( $p \leq 0.05$ ), with the BoNT-A cohort having larger alterations. Associations between normalized medial gastrocnemius volume and echo-intensity were highest in the No-BoNT-A cohort, followed by the BoNT-A cohort. Multiple regression analyses revealed that both GMFCS level and BoNT-A intervention history were significantly associated with smaller normalized medial gastrocnemius volume and higher echo-intensity. **INTERPRETATION:** Recurrent BoNT-A interventions may induce alterations to medial gastrocnemius volume and echo-intensity beyond the natural history of the spastic CP pathology.

PMID: [30320442](#)

### **10. Interaction between muscle tone, short-range stiffness and increased sensory feedback gains explains key kinematic features of the pendulum test in spastic cerebral palsy: A simulation study.**

De Groote F, Blum KP, Horslen BC, Ting LH.

PLoS One. 2018 Oct 18;13(10):e0205763. doi: 10.1371/journal.pone.0205763. eCollection 2018.

The pendulum test is a sensitive clinical assessment of spasticity where the lower leg is dropped from the horizontal position and features of limb motion are recorded. Three key kinematic features are associated with the degree of severity of spasticity in children with cerebral palsy: decreased initial limb excursion, reduced number of limb oscillations, and a non-vertical resting limb angle. While spasticity is attributed to increased velocity-dependent resistance to motion, prior models simulating increased sensorimotor feedback of muscle velocity fail to explain the key pendulum test kinematic outcomes in spastic individuals. Here we hypothesized that increased muscle tone, causing a transient increase in muscle force, i.e. short-range stiffness, could account for reduced first swing excursion and non-vertical resting limb angle. We further hypothesized that

hyperreflexia modeled based on muscle fiber force, and not velocity, feedback would be necessary to reduce the number of oscillations because of its interaction with transiently increased muscle force due to short-range stiffness. We simulated the lower leg as a torque-driven single-link pendulum. Muscle tone was modeled as a constant baseline joint torque, short-range stiffness torque was dependent on the level of muscle tone, and delayed sensory feedback torque to simulate reflex activity was based on either muscle velocity or force. Muscle tone and transient short-range stiffness were necessary to simulate decreased initial swing excursion and non-vertical resting leg angle. Moreover, the reduction in the number of oscillations was best reproduced by simulating stretch reflex activity in terms of force, and not velocity, feedback. Varying only baseline muscle torque and reflex gain, we simulated a range of pendulum test kinematics observed across different levels of spasticity. Our model lends insight into physiological mechanisms of spasticity whose contributions can vary on an individual-specific basis, and potentially across different neurological disorders that manifest spasticity as a symptom.

PMID: [30335860](#)

### 11. The utility of normative foot floor angle data in assessing toe-walking.

Vette AH, Watt JM, Lewicke J, Watkins B, Burkholder LM, Andersen J, Jhangri GS, Dulai S.

Foot (Edinb). 2018 Jul 11;37:65-70. doi: 10.1016/j.foot.2018.07.003. [Epub ahead of print]

Initial heel contact is an important attribute of gait, and failure to complete the heel rocker reduces gait stability. One common goal in treating toe-walking is to restore heel strike and prevent or reduce early heel rise. Foot floor angle (FFA) is a measure of toe-walking that is valuable for quantifying foot orientation at initial contact when using ankle dorsiflexion angle alone is misleading. However, no age-standardized FFA norms exist for clinical evaluation. Our objectives were to: (1) obtain normative FFA in typically developing children; and (2) examine its utility in the example of toe-walking secondary to unilateral cerebral palsy. Gait kinematics were acquired and FFA trajectories computed for 80 typically developing children (4-18 years). They were also obtained retrospectively from 11 children with toe-walking secondary to unilateral cerebral palsy (4-10 years), before and after operative intervention, and compared to 40 age-matched, typically developing children. FFA at initial contact was significantly different ( $P<.001$ ) between pre-surgery toe-walking ( $-14.7\pm 9.7^\circ$ ; mean $\pm$ standard deviation) and typical gait ( $18.7\pm 2.8^\circ$ ). Following operative lengthening of the gastrocnemius-soleus complex on the affected side, FFA at initial contact ( $-0.9\pm 5.3^\circ$ ) was significantly improved ( $P<.001$ ). Furthermore, several cases were identified for which the sole use of ankle dorsiflexion angle to capture toe-walking is misleading. The assessment of FFA is a simple method for providing valuable quantitative information to clinicians regarding foot orientation during gait. The demonstrated limitations of using ankle dorsiflexion angle alone to estimate foot orientation further emphasize the utility of FFA in assessing toe-walking.

PMID: [30326414](#)

### 12. Radiological outcome of calcaneo-cuboid-cuneiform osteotomies for planovalgus feet in cerebral palsy children: Relationship with pedobarography.

El-Hilaly R, El-Sherbini MH, Abd-Ella MM, Omran AA.

Foot Ankle Surg. 2018 Mar 26. pii: S1268-7731(18)30099-7. doi: 10.1016/j.fas.2018.02.019. [Epub ahead of print]

**BACKGROUND:** Calcaneo-cuboid-cuneiform (triple C) osteotomies correct all levels of deformity of flexible planovalgus feet (PVF) in patients with cerebral palsy (CP). The objective was assessing short term results and the hypothesis was that static pedobarography correlates with radiological parameters as outcome measures. **METHODS:** A prospective case series of consecutive skeletally immature ambulatory spastic CP patients above the age of 4 years who underwent triple C for PVF. Assessment was done using static pedobarography and standing dorsoplantar (DP) and lateral radiographs. The calcaneal pitch, lateral talocalcaneal, lateral and DP talo-first metatarsal, and DP talonavicular coverage angles were measured. **RESULTS:** Eighteen feet (12 patients) were analyzed. Postoperative changes in lateral and DP talo-first metatarsal, and DP talonavicular coverage angles were statistically significant ( $P$ -value=0 with paired T-test). Post operative foot pressure changes were significant and highest in mid-foot. Both outcomes were related together with a  $p$ -value of 1 using McNemar test. **CONCLUSIONS:** The triple C and associated soft tissue procedures reliably corrected PVF deformities. Static pedobarography can be used for postoperative assessment of adequate correction.

PMID: [30321957](#)

### 13. Respiratory morbidity in children with cerebral palsy: an overview.

Boel L, Pernet K, Toussaint M, Ides K, Leemans G, Haan J, Van Hoorenbeek K, Verhulst S.

Dev Med Child Neurol. 2018 Oct 15. doi: 10.1111/dmcn.14060. [Epub ahead of print]

Respiratory problems have a significant impact on morbidity and mortality in patients with cerebral palsy (CP). In particular, recurrent aspiration, impaired airway clearance, spinal and thoracic deformity, impaired lung function, poor nutritional status, and recurrent respiratory infections negatively affect respiratory status. Bronchopulmonary dysplasia may contribute to pulmonary problems, but asthma is not more common in CP than in the general population. We discuss treatment options for each of these factors. Multiple coexisting and interacting factors that influence the respiratory status of patients with CP should be recognized and effectively addressed to reduce respiratory morbidity and mortality. **WHAT THIS PAPER ADDS:** Respiratory problems are a significant cause of morbidity in patients with cerebral palsy (CP). Respiratory status in patients with CP is influenced by recurrent aspiration and impaired airway clearance. Spinal and thoracic deformity, impaired lung function, poor nutrition, and respiratory infections also negatively affect respiratory status. These factors should all be addressed to reduce respiratory problems in patients with CP.

PMID: [30320434](#)

#### **14. Salivary lead concentration in dental caries among normal and children with cerebral palsy.**

Vandal VB, Noorani H, Shivaprakash PK, Walikar BN.

J Indian Soc Pedod Prev Dent. 2018 Oct-Dec;36(4):381-385. doi: 10.4103/JISPPD.JISPPD\_200\_16.

**INTRODUCTION:** Cerebral palsy (CP) is a neurological disability the exact cause of which is not known. Exposure to toxic elements, environmental pollutants, and various teratogens such as lead, either prenatal or postnatal, can be a risk factor for this neurologic disability. CP children have poor neuromuscular coordination, exposing them to increased risk of oral diseases such as drooling of saliva, periodontal diseases, dental caries, and malocclusion. There are less studies comparing lead concentration in CP children, as it can be one of the contributing factors to dental caries. **AIMS AND OBJECTIVES:** The present study was to estimate and compare the salivary lead level in normal and neurologically disabled children and to correlate salivary lead level with dental caries in both normal and neurologically disabled children. **MATERIALS AND METHODS:** A study on 45 children reporting to CP rehabilitation center and 41 normal children taken from the Outpatient Department of the Pediatric and Preventive Dentistry, P.M.N.M. Dental College and Hospital, Bagalkot, Karnataka. All children were between the age group of 5-12 years. In all individuals, a thorough medical history and dental examination were done. The age, state of dentition, and the level of caries in all individuals were determined by the same examiner, and salivary lead concentrations were determined using atomic absorption spectrophotometer. All children were divided into four groups depending on the presence or absence of dental caries. Group 1 consisted of 20 normal children with dental caries, Group 2 consisted of 21 normal children without dental caries, Group 3 consisted of 25 CP children with dental caries, and Group 4 consisted of 20 CP children without dental caries. **RESULTS:** Were recorded tabulated and statistically analyzed. CP children had high decayed, missing, and filled teeth/def scores, dental caries, and salivary lead concentration as compared to normal children. Statistically significant correlation was obtained between the dental caries and saliva lead concentration. The lead concentration was directly proportional to the carious status. **CONCLUSION:** CP children are more prone to dental caries and increased salivary lead concentration which could be a cause as well as the effect of CP.

PMID: [30324929](#)

#### **15. A cross sectional study to evaluate the oral health status of children with intellectual disabilities in the National Capital Region of India (Delhi-NCR).**

Makkar A, Indushekar KR, Saraf BG, Sardana D, Sheoran N.

J Intellect Disabil Res. 2018 Oct 18. doi: 10.1111/jir.12553. [Epub ahead of print]

**BACKGROUND:** Children with intellectual disabilities (ID) have usually been reported to have poorer levels of oral hygiene and higher prevalence of dental caries than their peers. The present study was conducted to assess the status of dental caries and oral hygiene in different categories of institutionalised children with ID (syndromic and non-syndromic) registered in various special schools of Delhi (National Capital Region, India). **METHODS:** The present cross sectional study was conducted on 269 children [52 with cerebral palsy (CP), 35 with Down syndrome (DS), 30 with autism and 152 with non-syndromic intellectual disability] attending nine special schools who were examined for dental caries [Decayed, Missing and Filled Teeth index for permanent teeth (DMFT); decayed, missing/indicated for extraction, filled index for primary teeth (dmft) and prevalence of caries] and oral hygiene status [Oral Hygiene Index-simplified (OHI-S)]. The levels of disability were classified according to Stanford Binet scale as severe (IQ ≤ 35), moderate (IQ = 36-51) and mild (IQ = 52-67). Statistical analysis was performed using one way analysis of variance and post hoc test to compare the levels between groups at a

significance level of  $P < 0.05$ . RESULTS: Mean DMFT, dmft and OHI-S indices scores for all the children irrespective of the category and the level of ID were  $2.12 \pm 1.95$ ,  $0.97 \pm 1.60$  and  $2.05 \pm 1.07$ , respectively. As the level of ID increased among these children, the mean DMFT index and OHI-S index increased with no significant effect on dmft. However, children with severe ID had higher OHI-S and DMFT scores than children with mild or moderate ID. The dental caries prevalence was 86.53%, 68.57%, 76% and 86.18% in children with CP, DS, autism and non-syndromic intellectual disability, respectively. CONCLUSIONS: The level of caries in permanent teeth and oral hygiene deteriorated with the increasing severity of ID as indicated by DMFT and OHI-S scores (severe > mild, moderate). However, the level of caries (dmft) was not affected by the level of ID in primary dentition. The prevalence of dental caries was highest among children with CP and least among children with DS.

PMID: [30338591](#)

#### 16. Association between maternal overweight or obesity and cerebral palsy in children: A meta-analysis.

Xiao D, Qu Y, Huang L, Wang Y, Li X, Mu D.

PLoS One. 2018 Oct 16;13(10):e0205733. doi: 10.1371/journal.pone.0205733. eCollection 2018.

CONTEXT: There is no consensus regarding the association between maternal obesity or overweight and cerebral palsy (CP) in children. OBJECTIVES: To investigate whether maternal obesity or overweight is associated with CP and identify the factors that explain the differences in the study results. DATA SOURCES: We conducted a meta-analysis of studies published in English with titles or abstracts that discussed the relationships between maternal obesity or overweight and CP before August 23, 2017, using Ovid Medline, EMBASE and Web of Science. STUDY SELECTION: Of 2699 initially identified studies, 8 studies that addressed the association between maternal obesity and CP met our final inclusion criteria. DATA EXTRACTION: Information from the individual studies was abstracted using standardized forms by 2 independent observers who were blinded to the authors' names and journal titles. DATA SYNTHESIS: According to a random effects model, maternal overweight was significantly associated with CP in offspring [RR = 1.29 (95% CI, 1.04-1.60), heterogeneity ( $I^2 = 45.5\%$ ,  $P = 0.103$ )]; maternal obesity was significantly associated with CP in offspring [RR = 1.45 (95% CI, 1.25-1.69), heterogeneity ( $I^2 = 24.1\%$ ,  $P = 0.253$ )]; and maternal obesity III was significantly associated with CP in offspring [RR = 2.25 (95% CI, 1.82-2.79), heterogeneity ( $I^2 = 0\%$ ,  $P = 0.589$ )]. However, maternal underweight was not significantly associated with CP in offspring [RR = 1.11 (95% CI, 0.88-1.38), low heterogeneity ( $I^2 = 0\%$ ,  $P = 0.435$ )]. Factors that explained the differences in the meta-analysis results included study design, study location, and whether individual studies adjusted for potential confounders. CONCLUSION: This study suggests that maternal obesity and overweight increase the risk of CP in offspring. Further studies are required to confirm these results and determine the influence of variables across studies.

PMID: [30325944](#)

#### 17. Health of parents of individuals with developmental disorders or mental health problems: Impacts of stigma.

Song J, Mailick MR, Greenberg JS.

Soc Sci Med. 2018 Sep 27. pii: S0277-9536(18)30540-9. doi: 10.1016/j.socscimed.2018.09.044. [Epub ahead of print]

OBJECTIVE: Parents of individuals with developmental disorders or mental health problems often provide life-long care and support to their children, which negatively affects their health in part due to chronic stress. This study aimed to examine the experience of stigma as a source of chronic stress among parents of individuals with developmental disorders or mental health problems and the effect of stigma on parental health outcomes. METHOD: Using data from the Survey of Midlife in the United States (MIDUS 2 and 3), we constructed a sample for a longitudinal analysis including 128 parents of individuals with developmental disorders (e.g., autism, cerebral palsy, epilepsy, Down syndrome, intellectual disabilities, brain injury, ADD/ADHD) or mental health problems (e.g., bipolar disorder, schizophrenia, major depression) and 2256 parents whose children were nondisabled. RESULTS: Parents who had children with developmental disorders or mental health problems prior to the beginning of the study (i.e., at MIDUS 1) reported higher levels of stigma related to embarrassment/shame and daily discrimination than parents of nondisabled individuals ten years later at MIDUS 2, which in turn were associated with poorer parental health outcomes (poorer self-rated health and a greater number of chronic conditions) nearly a decade after that at MIDUS 3. CONCLUSIONS: The findings suggest that the stigma associated with parenting a child with disabilities may be one mechanism that places such parents at risk for poor health. Efforts to alleviate the stigma associated with developmental disorders or mental health problems may have beneficial effects on health of parents of individuals with such conditions.

PMID: [30333078](#)

**18. Commentary: Authors' Reply to Commentary: Cognitive Assessment of Infants With Motor Impairment: An Important Problem and Best Available Objective Evidence.**

Morgan C, Honan I, Allsop A, Novak I, Badawi N.

J Pediatr Psychol. 2018 Oct 18. doi: 10.1093/jpepsy/jsy082. [Epub ahead of print]

PMID: [30339255](#)

**19. Background EEG features and prediction of cognitive outcomes in very preterm infants: A systematic review.**

Kong AHT, Lai MM, Finnigan S, Ware RS, Boyd RN, Colditz PB.

Early Hum Dev. 2018 Oct 16;127:74-84. doi: 10.1016/j.earlhumdev.2018.09.015. [Epub ahead of print]

**OBJECTIVES:** Very preterm infants are at risk of cognitive impairment, but current capacity to predict at-risk infants is sub-optimal. Electroencephalography (EEG) has been used to assess brain function in development. This review investigates the relationship between EEG and cognitive outcomes in very preterm infants. **METHODS:** Two reviewers independently conducted a literature search in April 2018 using PubMed, CINAHL, PsycINFO, Cochrane Library, Embase and Web of Science. Studies included very preterm infants (born  $\leq 34$  weeks gestational age, GA) who were assessed with EEG at  $\leq 43$  weeks postmenstrual age (PMA) and had cognitive outcomes assessed  $\geq 3$  months of age. Data on the subjects, EEG, cognitive assessment, and main findings were extracted. Meta-analysis was undertaken to calculate pooled sensitivity and specificity. **RESULTS:** 31 studies (n = 4712 very preterm infants) met the inclusion criteria. The age of EEG, length of EEG recording, EEG features analysed, age at follow-up, and follow-up assessments were diverse. The included studies were then divided into categories based on their analysed EEG feature(s) for meta-analysis. Only one category had an adequate number of studies for meta-analysis: four papers (n = 255 very preterm infants) reporting dysmature/disorganised EEG patterns were meta-analysed and the pooled sensitivity and specificity for predicting cognitive outcomes were 0.63 (95% CI: 0.53-0.72) and 0.83 (95% CI: 0.74-0.89) respectively. **CONCLUSIONS:** There is preliminary evidence that background EEG features can predict cognitive outcomes in very preterm infants. Reported findings were however too heterogeneous to determine which EEG features are best at predicting cognitive outcome.

PMID: [30340071](#)

**20. Children With Cerebral Palsy Playing With Mainstream Robotic Toys: Playfulness and Environmental Supportiveness.**

Bulgarelli D, Bianquin N, Besio S, Molina P.

Front Psychol. 2018 Sep 26;9:1814. doi: 10.3389/fpsyg.2018.01814. eCollection 2018.

**Purpose:** Play is a right for every child and has a key role in child development. Play can be analyzed according to the construct of playfulness, which is the child's disposition to play. Children with cerebral palsy (CP) show difficulties in play and can also experience lower playfulness scores when compared to matched typically developing children. This paper analyses play and playfulness in children with CP using mainstream robotic toys with supporting adult play partners. **Methodology:** Five mainstream robotic toys were selected and used in play situations with six children with CP interacting with two adult partners. The play situations were coded through the Test of Playfulness (ToP) and the Test of Environmental Supportiveness (ToES), to analyze the role of robotic toys, adult partners and environment in supporting play and playfulness in children with CP. **Results:** The children obtained high ToP scores, showing that they were intrinsically motivated to be engaged in the play situations. The ToP scores weakly correlated with the ToES scores. To discuss this result, different features of each robot, the role of adults as scaffolder, and the space characteristics in supporting play are presented and discussed. **Conclusion:** This research field is new: to our knowledge, in the literature only one study focused on the use of one type of mainstream robotic toy to support the playfulness of children with CP. The parallel use of the ToP and the ToES was crucial to observe the complexity of the play situations and the role of playmates and toys during the play process. The role of the adult as play scaffolder has been important to mediate between the child with CP and the environment, toys included: the adult should be strongly aware of this role to better support the child in being in charge of the play situation. Further research is needed.

PMID: [30319509](#)



**21. Neurodevelopmental outcome of late preterm infants in Johannesburg, South Africa.**

Ramdin T, Ballot D, Rakotsoane D, Madzudzo L, Brown N, Chirwa T, Cooper P, Davies V.

BMC Pediatr. 2018 Oct 15;18(1):326. doi: 10.1186/s12887-018-1296-3.

**BACKGROUND:** Late preterm infants, previously considered low risk, have been identified to be at risk of developmental problems in infancy and early childhood. There is limited information on the outcome of these infants in low and middle income countries. **METHODS:** Bayley scales of infant and toddler development, version III, were done on a group of late preterm infants in Johannesburg, South Africa. The mean composite cognitive, language and motor sub-scales were compared to those obtained from a group of typically developed control infants. Infants were considered to be "at risk" if the composite subscale score was below 85 and "disabled" if the composite subscale score was below 70. Infants identified with cerebral palsy were also reported. **RESULTS:** 56 of 73 (76.7%) late preterm infants enrolled in the study had at least one Bayley assessment at a mean age of 16.5 months (95% CI 15.2-17.6). The mean birth weight was 1.9 kg (95%CI 1.8-2.0) and mean gestational age 33.0 weeks (95% CI 32.56-33.51). There was no difference in the mean cognitive subscales between late preterm infants and controls (95.4 9, 95% CI 91.2-99.5 vs 91.9, 95% CI 87.7-96.0). There was similarly no difference in mean language subscales (94.5, 95% CI 91.3-97.7 vs 95.9, 95% CI 92.9-99.0) or motor subscales (96.2, 95% CI 91.8-100.7 vs 97.6, 95% CI 94.7-100.5). There were four late preterm infants who were classified as disabled, two of whom had cerebral palsy. None of the control group was disabled. **CONCLUSIONS:** This study demonstrates that overall developmental outcome, as assessed by the Bayley scales of infant and toddler development, was not different between late preterm infants and a group of normal controls. However, 7.1% of the late preterm infants, had evidence of developmental disability. Thus late preterm infants in low and middle income countries require long term follow up to monitor developmental outcome. In a resource limited setting, this may best be achieved by including a parental screening questionnaire, such as the Ages and Stages Questionnaire, in the routine well baby clinic visits.

PMID: [30322374](#)**22. Distribution and motor ability of children with cerebral palsy in Scotland: a registry analysis.**

Bugler KE, Gaston MS, Robb JE.

Scott Med J. 2018 Oct 18;36933018805897. doi: 10.1177/0036933018805897. [Epub ahead of print]

**Background and aims:** Cerebral palsy is the commonest long-term physical disability in children with a prevalence of between 1.77 and 2.11/1000 live births. In 2013, the Cerebral Palsy Integrated Pathway Scotland (CPIPS) surveillance programme was introduced in all 14 Health Boards in Scotland and provides a standardised musculoskeletal examination of the spine and lower limbs. The purpose of this study was to report the prevalence, subtypes, motor classification and motor ability of children with cerebral palsy in Scotland. **Methods and results:** The family/carer's postal address, the child's neurological classification, motor subtypes, Gross Motor Functional Classification (GMFCS) Level and Functional Mobility Scale of 1972 children at first registration in CPIPS 2013-2018 were analysed. Their mean age at first assessment was 7.6 years. There was an overall prevalence of cerebral palsy in Scotland of 2.02/1000. GMFCS levels and Functional Mobility Scale data and prevalence were reported by Health Board and were comparable to that reported elsewhere. **Conclusion:** For the first time, data are available on the motor abilities of the total population of children with cerebral palsy in Scotland. This information will be highly relevant to resource management of current and future motor needs of these children.

PMID: [30336740](#)**23. The Role of the Pediatric Neurologist in the Care of Children With Neurodevelopmental Disabilities.**

Shevell M.

Pediatr Neurol. 2018 Aug 10. pii: S0887-8994(18)30831-2. doi: 10.1016/j.pediatrneurol.2018.08.004. [Epub ahead of print]

PMID: [30318285](#)

## Prevention and Cure

### 24. Magnesium sulfate and fetal neuroprotection: overview of clinical evidence.

Chollat C, Marret S.

Neural Regen Res. 2018 Dec;13(12):2044-2049. doi: 10.4103/1673-5374.241441.

Antenatal administration of magnesium sulfate is an important part of the neuroprotective strategy for preterm infants. Strong evidence from five randomized controlled trials and five meta-analyses has demonstrated that magnesium sulfate, when administered before preterm delivery, significantly reduces the risk of cerebral palsy at two years. Through secondary analyses of randomized controlled trials and other original clinical studies, this state-of-the-art review highlights the absence of serious adverse effects in both pregnant women and neonates, as well as the impact of maternal body mass index and preeclamptic status on the maternal and neonatal magnesium levels, which could influence the magnitude of the neuroprotective effect. Although antenatal magnesium sulfate is a cost-effective strategy, some practice surveys have demonstrated that the use of magnesium sulfate is not sufficient and that its use is heterogeneous, differing among different maternity wards. Since 2010, an increasing number of obstetrical societies have recommended its use to improve the neurological outcomes of preterm infants, especially the International Federation of Gynecology and Obstetrics and World Health Organization in 2015, and France in 2017. Considering the neuroprotective impact of magnesium sulfate when administered before delivery, postnatal administration should be considered, and its effects should be assessed using randomized controlled trials.

PMID: [30323118](#)

### 25. Risk of cerebral palsy by gestational age among pregnancies at-risk for preterm birth.

Smith DD, Sagaram D, Miller R, Gyamfi-Bannerman C.

J Matern Fetal Neonatal Med. 2018 Oct 14:1-11. doi: 10.1080/14767058.2018.1536745. [Epub ahead of print]

**OBJECTIVE:** Our objective was to describe cerebral palsy (CP) incidence stratified by gestational age (GA) groups within a group at risk for spontaneous preterm birth (sPTB). **STUDY DESIGN:** This is a secondary analysis of a large study of magnesium for neuroprotection. Nonanomalous, singleton gestations complicated by preterm premature rupture of membranes (PPROM) or preterm labor (PTL) were included. Infants that developed CP were compared to controls that did not. The incidence of CP was stratified by GA groups. A logistic regression model was fit to adjust for confounders. **RESULTS:** Of 1747 included pregnancies, 75 (4.3%) were affected by CP. Increasing GA at delivery was associated with lower rates of CP (RR 0.96, 95% CI 0.95-0.97;  $p < 0.0001$ ). The most significant risk factor for CP was neonatal sepsis while the most significant protective factors were magnesium and antibiotic exposure. In the adjusted analysis, magnesium exposure (aRR 0.52, 95% CI 0.33-0.84;  $p = 0.007$ ) and antibiotic exposure (aRR 0.52, 95% CI 0.28-0.95;  $p = 0.034$ ) remained protective. **CONCLUSION:** The risk of CP among populations at high risk for sPTB decreases with advancing GA. While the majority of cases of CP occurred in children born  $< 34$  weeks, residual risk persisted thereafter. The effect of magnesium exposure is most pronounced before 28 weeks.

PMID: [30318944](#)

### 26. Pulse Oximeter Saturation Targeting and Oximeter Changes in the Benefits of Oxygen Saturation Targeting (BOOST)-II Australia and BOOST-II UK Oxygen Trials.

Stenson BJ, Donoghoe M, Brocklehurst P, Davis PG, Juszczak E, Marschner IC, Simes J, Tarnow-Mordi WO.

J Pediatr. 2018 Oct 9. pii: S0022-3476(18)31207-1. doi: 10.1016/j.jpeds.2018.08.033. [Epub ahead of print]

Infants in the Australian and UK Benefits of Oxygen Saturation Targeting-II trials treated using revised oximeters spent more time within their planned pulse oximeter saturation target ranges than infants treated using the original oximeters ( $P < .001$ ). This may explain the larger mortality difference seen with revised oximeters. If so, average treatment effects from the Neonatal Oxygen Prospective Meta-analysis trials may be underestimates.

PMID: [30314661](#)