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Interventions and Management

1. The use of functional electrical stimulation to improve upper limb function in children with hemiplegic cerebral palsy: A feasibility study.

Garzon LC, Switzer L, Musselman KE, Fehlings D.

J Rehabil Assist Technol Eng. 2018 May 14;5:2055668318768402. doi: 10.1177/2055668318768402. eCollection 2018 Jan-Dec.

Background: Grasping and manipulating objects are common problems for children with hemiplegic cerebral palsy. Multichannel-functional electrical stimulation may help facilitate upper limb movements and improve function. Objective: To evaluate the feasibility of multichannel-functional electrical stimulation to improve grasp and upper limb function in children with hemiplegic cerebral palsy to inform the development of a clinical trial. Methods: A prospective pre-/post-test/follow-up (six months) design with three children, aged 6-13 years, was used. Multichannel-functional electrical stimulation (mFES) was applied to the hemiplegic upper limb for up to 48 sessions over 16 weeks. Feasibility indicators included recruitment of participants and adherence rates, safety, and discomfort/pain. Effectiveness was assessed using the grasp domain of the Quality of Upper Extremity Skills Test, and other secondary clinical outcome measures with "success" criteria set a priori. Results: Participant recruitment target was not met but adherence was high, and multichannel-functional electrical stimulation was found to be safe and comfortable. Of the three participants, two improved in grasp at post-test, whereas one child's ability deteriorated. Only one child met success criteria on most outcomes at post-test. Conclusions: Feasibility indicators met success criteria, except for participant recruitment. Treatment effectiveness was mixed. A future case comparison investigation with a larger but more selected sample is suggested.

PMID: [31191936](#)

2. Selective dorsal rhizotomy in cerebral palsy spasticity - a newly established operative technique in Slovenia: A case report and review of literature.

Velnar T, Spazzapan P, Rodi Z, Kos N, Bosnjak R.

World J Clin Cases. 2019 May 26;7(10):1133-1141. doi: 10.12998/wjcc.v7.i10.1133.

BACKGROUND: Spasticity affects a large number of children, mainly in the setting of cerebral palsy, however, only a few paediatric neurosurgeons deal with this problem. This is mainly due to the fact that until 1979, when Fasano has published the first series of selective dorsal rhizotomy (SDR), neurosurgeons were able to provide such children only a modest help. The therapy of spasticity has made a great progress since then. Today, peroral drugs, intramuscular and intrathecal medicines are available, that may limit the effects of the disease.

In addition, surgical treatment is gaining importance, appearing in the form of deep brain stimulation, peripheral nerve procedures and SDR. All these options offer the affected children good opportunities of improving the quality of life. **CASE SUMMARY:** A 15-year old boy is presented that was surgically treated for spasticity as a result of cerebral palsy. Laminotomy at L1 level was performed and L1 to S1 nerve roots were isolated and divided in smaller fascicles. Then, the SDR was made. **CONCLUSION:** We describe a patient report and surgical technique of SDR that was performed in Slovenia for the first time.

PMID: [31183344](#)

3. Test-retest reliability and minimal detectable change for measures of balance and gait in adults with cerebral palsy.

Levin I, Lewek MD, Giuliani C, Faldowski R, Thorpe DE.

Gait Posture. 2019 May 28;72:96-101. doi: 10.1016/j.gaitpost.2019.05.028. [Epub ahead of print]

BACKGROUND: Walking and balance often begin to deteriorate in ambulant adults with cerebral palsy (CP) in early adulthood. The decline in walking and balance imposes a more sedentary lifestyle, increases falls risk, negatively affects health, participation, and quality of life, and ultimately results in increased disability. Available research is not sufficient to guide interventions to improve walking and balance in this population. To advance research in this area, there is a need for measures of gait and balance with proven psychometrics for adults with CP. **RESEARCH QUESTION:** The goal of this study was to determine test-retest reliability and minimal detectable change (MDC) values and to assess score distribution for the Balance Evaluation Systems Test (BESTest) and the Four Square Step Test (FSST) as measures of balance, for the Activities-specific Balance Confidence (ABC) Scale and the Modified Fall Efficacy Scale (MFES) as measures of balance confidence, and for over-ground spatiotemporal gait parameters at comfortable gait speed (CGS) and fast gait speed (FGS). **METHODS:** Twenty ambulant adults with CP (mean age 32.7 years), GMFCS-E&R Levels I and II, were tested twice within an average of 10 days. Test-retest reliability was evaluated using intra-class correlation coefficients (ICC_{2,1}), and MDC₉₅ values were calculated using standard error of measurement values. **RESULTS:** The test-retest reliability of most outcome measures was good to excellent. ICC values were: BESTest = 0.99, BESTest sections 0.88 to 0.98, FSST = 0.91, ABC = 0.86, MFES = 0.9, CGS = 0.88, and FGS = 0.98. MDC values were: BESTest total = 4.9%, BESTest sections 8.7%-21.2%, FSST = 3.7 s, ABC = 18%, MFES = 1 point, CGS = 0.26 m/s, and FGS = 0.14 m/s. Most outcome scores were broadly distributed over scales ranges. **SIGNIFICANCE:** Adults with CP demonstrated stable test-retest performance on the selected measures. These measures could be useful to assess balance and gait of adults with CP. The MDC values can help evaluate whether observed changes exceed the expected random test-retest variations.

PMID: [31177021](#)

4. Effects of transcranial direct current stimulation (tDCS) on balance improvement: a systematic review and meta-analysis.

de Moura MCDS, Hazime FA, Marotti Aparicio LV, Grecco LAC, Brunoni AR, Hasue RH.

Somatosens Mot Res. 2019 Jun 11:1-14. doi: 10.1080/08990220.2019.1624517. [Epub ahead of print]

Background: Transcranial direct current stimulation (tDCS) has emerged as a promising therapeutic tool to improve balance and optimize rehabilitation strategies. However, current literature shows the methodological heterogeneity of tDCS protocols and results, hindering any clear conclusions about the effects of tDCS on postural control. **Objective:** Evaluate the effectiveness of tDCS on postural control, and identify the most beneficial target brain areas and the effect on different populations. **Methods:** Two independent reviewers selected randomized tDCS clinical-trials studies from PubMed, Scopus, Web of Science, and reference lists of retrieved articles published between 1998 and 2017. Most frequently reported centre of pressure (COP) variables were selected for meta-analysis. Other postural control outcomes were discussed in the review. **Results:** Thirty studies were included in the systematic review, and 11 were submitted to a meta-analysis. A reduction of COP displacement area has been significantly achieved by tDCS, evidencing an improvement in balance control. Individuals with cerebral palsy (CP) and healthy young adults are mostly affected by stimulation. The analysis of the impact of tDCS over different brain areas revealed a significant effect after primary motor cortex (M1) stimulation, however, with no clear results after cerebellar stimulation due to divergent results among studies. **Conclusions:** tDCS appears to improve balance control, more evident in healthy and CP subjects. Effects are observed when primary MI is stimulated. Cerebellar stimulation should be better investigated.

PMID: [31181963](#)

5. Efficacy of an activity monitor as a biofeedback device in cerebral palsy.

Sharan D, Rajkumar JS, Balakrishnan R.

J Rehabil Assist Technol Eng. 2016 Nov 24;3:2055668316676032. doi: 10.1177/2055668316676032. eCollection 2016 Jan-Dec.

Background: Assessment of physical outcomes in patients with cerebral palsy (CP) is considered an effective way to monitor their progress, evaluate interventions and guide health care policy. However, no study using an activity monitor (AM) as a biofeedback device in treatment of people with CP has been published. Hence, the objective of this study was to evaluate the use of the AM as a biofeedback device in individuals with CP after a type of single-event multilevel surgery (SEMLS) called Single-Event Multilevel Lever Arm Restoration and Anti-Spasticity Surgery (SEMLARASS). **Method:** A randomized, controlled trial was conducted among 40 individuals with CP in the age group between 10 to 20 years who underwent SEMLARASS. They were randomly assigned to two groups: Group A (n = 20) and Group B (n = 20). Both groups received intensive rehabilitation including different types of activity-based training for around three hours per day. Both groups were assessed with standard subjective outcomes (Physician Rating Scale (PRS), Dynamic Gait Index (DGI) and Functional Mobility Scale (FMS)) and objective outcomes with the use of an AM (IntenzLife, Model No. 56084-1) for measuring step count, distance walked and calories used. During the intervention, for Group A, they were also given an AM after presetting individualized stride length and body weight, to monitor their daily activity levels. The AM was worn around the neck of the person throughout the day and provided a daily report of the measurements and acted as a biofeedback device for individuals with CP who were given specific targets to achieve on a weekly basis. Both groups were evaluated before and after eight weeks of intensive rehabilitation. **Results:** Group A showed significant differences in the scores of step count ($p < 0.001$), distance walked ($p < 0.001$), PRS ($p < 0.001$), DGI ($p < 0.010$) and FMS ($p < 0.001$) when compared to Group B after intensive rehabilitation. However, the calories used ($p < 0.086$) was not significantly different. **Conclusion:** The AM, which is considered to be a valid and reliable tool for assessing the level of physical activity in CP, can also be used as a biofeedback device for improving specific walking parameters in persons with CP post-SEMLARASS.

PMID: [31186915](#)

6. Total Joint Arthroplasty in Patients With Cerebral Palsy.

Moon AS, Pinto MC, Cichos KH, McGwin G Jr, Ponce BA, Ghanem ES.

J Am Acad Orthop Surg. 2019 Jun 6. doi: 10.5435/JAAOS-D-18-00828. [Epub ahead of print]

INTRODUCTION: Cerebral palsy (CP) is a neurodevelopmental condition with a wide range of presentations that usually lead to muscle imbalance culminating with precocious knee and hip arthrosis, often leading to total hip (THA) and knee arthroplasty (TKA). This study sought to determine the following: (1) the inherent differences of in-hospital characteristics and comorbidities between CP and non-CP patients undergoing total joint arthroplasty (TJA) and (2) do patients with CP have an increased risk of perioperative complications after TJA? **METHODS:** The Nationwide Inpatient Sample database from 2005 to 2014 was queried in this retrospective cohort study to compare patient demographics and comorbidities, hospital characteristics, perioperative complications, and length of stay in patients with CP undergoing TJA compared with their non-CP counterparts. Statistical analyses were performed using the Rao-Scott chi-square test and analysis of variance. All analyses took into account the sampling procedure and weighting. **RESULTS:** A total of 2,062 and 2,193 patients with CP underwent THA and TKA, respectively, during the study period. Both CP groups were younger ($P < 0.0001$), were more likely to have Medicaid insurance ($P < 0.0001$), and had longer lengths of hospital stay ($P < 0.0001$) compared with their non-CP counterparts. Non-CP patients had significantly higher rates of obesity, coronary artery disease, diabetes, and peripheral vascular disease ($P < 0.05$). However, patients with CP undergoing THA had a lower Charlson Comorbidity Index ($P = 0.0002$), whereas those undergoing TKA had similar comorbidity profile as the non-CP group ($P = 0.097$). Both THA and TKA CP patients had a higher risk of overall postoperative complications ($P < 0.05$) and surgical complications ($P < 0.05$), in particular acute postoperative anemia ($P < 0.05$). **CONCLUSION:** Despite being younger with fewer comorbidities, patients with CP are at an increased risk of immediate perioperative complications after TJA compared with the general osteoarthritis population. Given that these patients have satisfactory long-term outcomes after TJA, these procedures can be performed successfully for patients with CP with careful medical management and surgical planning. **LEVEL OF EVIDENCE:** Level III, retrospective cohort study.

PMID: [31181029](#)

7. Anorexia and supracondylar fracture of the femur following surgery for bilateral lower limb joint contracture in a case of severe cerebral palsy with mental retardation: a case report.

Takeuchi R, Mutsuzaki H, Mataka Y, Kamada H.

J Rural Med. 2019 May;14(1):120-124. doi: 10.2185/jrm.2983. Epub 2019 May 30.

Objective: Postoperative management of children having cerebral palsy (CP) with mental retardation is difficult. This report presents a case of severe CP with mental retardation, which resulted in anorexia and condylar fracture of the femur following a surgery for bilateral lower limb joint contracture. Case report: A 14-year-old male was diagnosed with CP having severity of Gross Motor Functional Classification System Level V, and severe mental retardation. Due to bilateral spasticity in hip adduction, knee flexion, and valgus of the feet, tenotomies of the adductors of both hips, bilateral lengthening of the hamstrings and bilateral tenotomy of the peroneal tendons were performed. At 4 weeks postoperatively, knee casts were used; thereafter, knee extension braces were attached for 12 weeks. After surgery, he showed severe anorexia for 8 weeks and weight loss of 8.8 kg (from 35.2 kg to 26.4 kg) during the 4 months of hospitalization. Six months postoperatively, he was diagnosed with supracondylar fracture of the right femur. Discussion: Severe CP with mental retardation requires attention to the physical symptoms caused by stress related to the hospitalization, surgery, fixation by casts, and braces. Moreover, care must be taken not to increase the risk of fracture by fixation or immobility of the postoperative cast, because it can lead to the progression of low bone mineral density.

PMID: [31191776](#)

8. Adapting ride-on toy cars as a tool to promote leisure: A feasibility study in Colombia.

Restrepo P BME, Velásquez J MScEng, Múnera S MRScT, Quintero Valencia CA MSPH.

Assist Technol. 2019 Jun 14:1-6. doi: 10.1080/10400435.2019.1611675. [Epub ahead of print]

Go Baby Go is a program at the University of Delaware that adapts ride-on toy cars for the recreation of children with disabilities. Colombia's health-care system faces many challenges in delivering early mobility devices to these children; thus, here (in Colombia), no dedicated programs such as Go Baby Go exist. In this study, we examined how feasible it would be to implement a Go Baby Go program in our country. Electronic and seating adaptations to the cars were made and described. We chose three participants from a pool of children with cerebral palsy (Gross Motor Function Classification System IV), according to a set of inclusion and exclusion criteria. Then, we measured theirs and their parent's level of satisfaction with the experience through a Likert scale. All of the parents described seeing their kids ride the adapted cars as "extremely fun". They also said that it is "extremely important" to have these devices close by so that their children can get involved in recreational activities.

PMID: [31199193](#)

9. One-Minute Walk Test in Children with Cerebral Palsy GMFCS Level 1 and 2: Reference Values to Identify Therapeutic Effects after Rehabilitation.

Martakis K, Stark C, Rehberg M, Semler O, Duran I, Schoenau E.

Dev Neurorehabil. 2019 Jun 10:1-9. doi: 10.1080/17518423.2019.1625981. [Epub ahead of print]

Background: Children with cerebral palsy (CP) show age-driven development and individual fluctuations in walking capacity. Aim: 1. To precisely quantify 1MWT changes in children with CP, GMFCS level 1 and 2, generating 1MWT percentiles, depicting expected development over 6 months; 2. to assess the effect of a 6-month rehabilitation using whole-body vibration (WBV). Methods: Retrospective data analysis in 210 children with CP, GMFCS 1 and 2 who received standardized rehabilitation (DRKS00011331). 1MWT was assessed before (M0) and after treatment (M6), and at a 6-month follow-up (M12). Centiles were created using the lambda-mu-sigma method. Cohen's d was used to assess effect size. Results: We created 1MWT percentiles using data of all 210 children (M0 data). A small treatment effect size ($d = 0.46$) was found (M6 and M12 data). Conclusions: Using the generated centiles clinicians may monitor 1MWT changes over 6 months. Combining WBV and conventional physiotherapy may improve 1MWT in children with CP. Abbreviations: 1MWT: One-Minute Walk Test; 6MWT: Six-Minute Walk Test; CP: Cerebral palsy; ES: effect size; GMFCS: Gross Motor Function Classification System;

GMFM-66: Gross Motor Function Measure 66; LOESS: Locally Estimated Scatterplot Smoothing; LMS: lambda-mu-sigma; SD: standard deviation; WBV: whole-body-vibration.

PMID: [31177878](#)

10. Clinical evaluation of a low-cost robot for use in physiotherapy and gait training.

Volpini M, Bartenbach V, Pinotti M, Riener R.

J Rehabil Assist Technol Eng. 2017 Jan 1;4:2055668316688410. doi: 10.1177/2055668316688410. eCollection 2017 Jan-Dec.

Background: Robotic-assisted gait training, a viable and promising therapeutic option for neurological rehabilitation, is not widely adopted in developing countries because of its high cost. In this paper, we describe the concept and construction of a low-cost robot prototype to restore walking ability in children with neurological dysfunction. Methods: The proposed robot consists of an orthosis, a treadmill, a body weight support system and two ankle guidance systems that move the ankles along a physiological kinematic trajectory. The spatiotemporal gait parameters of 60 children with typical development and children with cerebral palsy (aged 7-10 years) were obtained through clinical tests and compared with those provided by the robot. Results: The robotic orthosis presents normative values for stride length, step length and cadence during the typical development of children's gait speed and allows speed adjustments according to the degree of neuromotor impairment. Conclusion: The results evidence the high feasibility of developing a low-complexity rehabilitation device compliant with the physiological trajectory of the ankle as well as with several other physiological gait parameters.

PMID: [31186922](#)

11. Effect of a Combined Stretching and Strength Training Program on Gait Function in Children with Cerebral Palsy, GMFCS Level I & II: A Randomized Controlled Trial.

Fosdahl MA, Jahnsen R, Kvalheim K, Holm I.

Medicina (Kaunas). 2019 Jun 6;55(6). pii: E250. doi: 10.3390/medicina55060250.

Background and objectives: Ambulant children with cerebral palsy (CP) often develop impaired gait, and reduced active knee extension is often a part of the problem. This study aimed to evaluate the effect of a combined intervention program including stretching and progressive resistance exercise (PRE) targeting active knee extension on gait function, in children with spastic CP. Materials and methods: Thirty-seven children (21 boys, 16 girls, mean age 10.2 (\pm 2.3) years), classified by Gross Motor Function Classification System I-III, were randomized to an intervention (n = 17) and a comparison group (n = 20). The intervention group received a 16-week combined exercise program (3 sessions per week) including stretching of hamstrings and PRE targeting the lower extremities, followed by a 16-week maintenance program (1 session per week). The comparison group received care as usual. Gait function was evaluated by three-dimensional gait analysis (3DGA); knee, hip and pelvic kinematics in the sagittal plane, step length and speed, Gait Deviation Index (GDI), and Six-Minute Walk test (6MWT) at 0, 16, and 32 weeks. Results: There were no statistically significant differences between the intervention group and the comparison group for any of the gait parameters measured at 16 and 32 weeks. There was a significant increase in gait distance measured by 6MWT within both groups; however, no differences between the groups were found. Conclusion: A 16-week combined stretching and PRE program followed by a 16-week maintenance program did not improve gait function in ambulant children with CP.

PMID: [31174397](#)

12. The Home Program Evaluation Questionnaire - HoPE-Q - for Infants with Hemiplegic Cerebral Palsy: Development and Psychometric Properties.

Chamudot R, Gross-Tsur V, Horovitz R, Parush S.

Phys Occup Ther Pediatr. 2019;39(3):324-336. doi: 10.1080/01942638.2018.1534920. Epub 2019 Jan

To develop and examine the psychometric properties of the Home Program Evaluation Questionnaire (HoPE-Q), a novel tool designed to assess the effectiveness of home treatment programs for infants with hemiplegia.

The HoPE-Q includes a pre- and a postintervention version and items that relate to Child's Function, Parents' Competence, and their Expectations and Satisfaction from the program. The research was performed in three stages. The first stage consisted of item construction and content validity, followed by the analyses of the tool's reliability and construct validity. The final stage involved the examination of the tool's sensitivity to determine its suitability as an outcome measure of the effectiveness of home programs for infants with hemiplegia. Results showed moderate-to-high internal consistency ($\alpha = 0.65-0.85$) and high test-retest reliability in Child's Function and Parents' Competence ($r = 0.75$, $r = 0.76$) respectively ($p = 0.01$). Evidence for Construct Validity, was demonstrated by significant group difference in the Child's Function ($t(74) = -12.3$, $p \leq 0.001$) and Parents' Competence ($t(68) = -3.7$, $p = 0.01$), and high sensitivity to change after treatment was presented in Child's Function ($F(32,1) = 49.38$) and Parents Competence ($F(32,1) = 26.72$) ($p \leq 0.001$). Preliminary data support the validity and reliability of the HoPE-Q as well as its suitability as an outcome measure, thereby providing a means of examining the effectiveness of home intervention programs for infants with hemiplegia.

PMID: [31179851](#)

13. Improvement of motor performance in children with cerebral palsy treated with exoskeleton robotic training: A retrospective explorative analysis.

Digiaco F, Tamburin S, Tebaldi S, Pezzani M, Tagliaferro M, Casale R, Bartolo M.

Restor Neurol Neurosci. 2019 Jun 1. doi: 10.3233/RNN-180897. [Epub ahead of print]

BACKGROUND: Robot-assisted gait training (RAGT) is widely used in children with cerebral palsy (CP), but information about optimal intervention frequency and duration is still lacking and the current evidence about effect of RAGT on motor endurance and fitness is very preliminary. **OBJECTIVE:** To investigate the effect of RAGT on motor performance and endurance in children affected by CP. **METHODS:** Data from 14 consecutive children (6 females, age range: 4.6-15.8 years) affected by CP, who underwent a multidisciplinary rehabilitation program during a 18-24 month period, were retrospectively collected. Rehabilitation program included conventional physical therapy and RAGT (60/60 minutes, 20 daily sessions, 5 days/week). CP severity was stratified according to the Gross Motor Function Classification System. Clinical evaluation was performed by means of the six-minute walking test, the modified Ashworth scale, and RAGT measures (total distance, mean distance for session and speed). **RESULTS:** Clinical outcomes and speed did not improve after treatment, while total distance ($p = 0.006$) and mean distance for session ($p = 0.007$) significantly improved. **CONCLUSIONS:** Our preliminary study suggests that RAGT combined with conventional treatment may improve motor performance and endurance in children with CP. Future randomized controlled trials comparing RAGT to conventional treatment are needed.

PMID: [31177250](#)

14. Effectiveness of a low-cost body weight support training device in the rehabilitation of cerebral palsy.

Sharan D, Rajkumar JS, Balakrishnan R, Kulkarni A, Selvakumar K, Gampa S, Mohandoss M, Ranganathan R.

J Rehabil Assist Technol Eng. 2016 Nov 29;3:2055668316676047. doi: 10.1177/2055668316676047. eCollection 2016 Jan-Dec.

Background: Body weight supported treadmill training (BWSTT) has been proven to be effective in rehabilitation of persons with cerebral palsy (CP). However, it has still not found widespread usage, especially in industrially developing countries, due to its high cost. Treadmill training promotes a rhythmical movement of the lower extremities through motor learning, which can be enhanced by BWSTT for persons with CP. Hence, the research and development team of a tertiary level neuromusculoskeletal rehabilitation center designed a low-cost body weight support training (BWST) device. The aim of this study was to evaluate the effectiveness of the BWST device on gait and ambulation in persons with CP post single-event multilevel surgery (SEMLS) of the lower extremities. **Method:** A randomized controlled trial was conducted in 50 persons with CP aged between 5 and 20 years, who underwent a type of SEMLS called single-event multilevel lever arm restoration and anti-spasticity surgery (SEMLARASS). They were randomly assigned to two groups: group A ($n = 25$) received gait training and treadmill training with the BWST device, and group B ($n = 25$) received gait training and treadmill training without the BWST device. The designed BWST device was manually operated and based on an un-weighting principle in which a vest of different sizes un-weighted 10-30% of the individual's weight transmitted to the ground by means of adjustable counterweights fixed on a movable metallic frame which had an adjustable top lever (holding the vest) and a handle bar for the patient to hold.

The entire cost for the finished BWST device was estimated around 700 USD. The study duration was 5 weeks with 1 h of intervention per day for 6 days per week. Physician Rating Scale (PRS), Dynamic Gait Index (DGI) and Functional Mobility Scale (FMS) were the primary outcome measures. Results: Group A showed significant positive differences in the scores of PRS ($p < 0.001$), DGI ($p < 0.001$) and FMS ($p < 0.01$) when compared with group B, 5 weeks after the intervention, and the results were maintained at a follow-up of 12 months. Conclusion: The low-cost BWST device was found to be clinically effective in improving gait and ambulation in persons with CP following SEMLARASS.

PMID: [31186916](#)

15. Strabismus is correlated with gross motor function in children with spastic cerebral palsy.

Jeon H, Jung J, Yoon JA, Choi H.

Curr Eye Res. 2019 Jun 13. doi: 10.1080/02713683.2019.1631851. [Epub ahead of print]

Purpose: To investigate the correlation between clinical features of strabismus and motor dysfunction classified according to the Gross Motor Function Classification System (GMFCS) in patients with spastic cerebral palsy (CP). Methods: In this retrospective, cross-sectional study in single tertiary medical center, 62 patients who are diagnosed with spastic CP who had an ophthalmic examination between 2006 and 2014 were included. Only patients with vision sufficient to fixate were included and patients with restrictive or paralytic strabismus were excluded. The types of CP were classified as diplegia, hemiplegia, or quadriplegia for distribution of motor impairment. The GMFCS was used to grade gross motor dysfunction, which was then classified as mild (grade 1, 2 and 3) or severe (grade 4 and 5) motor impairment. Strabismus was investigated in terms of direction, constancy, and deviation angle. The relationship between strabismus characteristics and the level of GMFCS and type of CP were assessed. Results: Thirty-eight and 24 patients had mild or severe motor deficit, respectively. Forty patients had strabismus, which was more frequent in patients with severe motor impairment. ($P=0.014$) Exotropia and esotropia occurred with similar frequency. Constant and large-angle strabismus was frequently observed in patients with severe motor impairment. ($P < 0.005, 0.027$) The topographical subtype of CP was not related to clinical features of strabismus. Conclusions: The prevalence of strabismus is higher in severe motor impairment. The constancy and angle of strabismus was related to the severity of motor impairment while the topographical subtype of CP was not.

PMID: [31189336](#)

16. Children with cerebral palsy display altered neural oscillations within the visual MT/V5 cortices.

VerMaas JR, Gehringer JE, Wilson TW, Kurz MJ.

Neuroimage Clin. 2019 May 28;23:101876. doi: 10.1016/j.nicl.2019.101876. [Epub ahead of print]

Cortical visual processing in visual MT/V5 is necessary for tracking movement and performing reliable visuomotor transformations. Although the role of this cortical area is well recognized, the activity of the visual MT/V5 cortical area in children with cerebral palsy (CP) has not been examined nor has its potential role in the atypical motor actions of these children been considered. This study used magnetoencephalography to image the neural activity in the motion-sensitive MT/V5 cortices of typically developing (TD) children ($n = 21$; mean age 14 yrs. ± 2 , 12 males) and children with CP ($n = 21$; mean age 16 yrs. ± 4 , 13 males) as they viewed a horizontally moving stimulus. Behavioral measures of visual perception were additionally assessed by having the participants press a button when the visual stimulus changed to moving in vertical direction. Our results showed that the horizontal movement of the visual stimulus evoked changes in the strength of the theta-alpha (5-10 Hz) and alpha-beta (8-20 Hz) oscillations in the visual MT/V5 area of all participants. Compared with the TD children, the children with CP had weaker alpha-beta oscillations in the visual MT/V5 cortices. In addition, the children with CP took longer to perceive a directional change of the visual stimulus and made more errors in detecting the change. Lastly, weaker alpha-beta oscillations were correlated with slower detection of the change in motion direction and less accuracy in identifying the change. This study shows that the uncharacteristic neural oscillations in the visual MT/V5 cortical area may partially account for the abnormal perceptions and motor decisions seen in children with CP.

PMID: [31176292](#)

17. Visual Function Classification System for children with cerebral palsy: development and validation.

Baranello G, Signorini S, Tinelli F, Guzzetta A, Pagliano E, Rossi A, Foscan M, Tramacere I, Romeo DMM, Ricci D.

Dev Med Child Neurol. 2019 Jun 10. doi: 10.1111/dmcn.14270. [Epub ahead of print]

AIM: To develop and validate the Visual Function Classification System (VFCS), which was created to classify how children with cerebral palsy (CP) use visual abilities in daily life. **METHOD:** The process of development and validation of the VFCS involved four phases: (1) drafting of the five levels from the analysis of literature and clinical experience; (2) validation of constructs and revision of the levels for concept meaningfulness, using nominal group process; (3) refinement by international Delphi survey; and (4) assessment of interrater reliability among professionals and with caregivers, and of test-retest reliability. **RESULTS:** Five nominal groups involved 29 participants; 65 people completed the first round and 51 the second round of the Delphi survey. Construct validity was demonstrated within an expert group and external validation through several stakeholders, with the involvement of patients and families to ensure meaningfulness of the concept. Discussions continued until consensus was reached about the construct and content of the five levels. Participants in the reliability study included 29 professionals, 39 parents, and a total sample of 160 children with CP (mean age [SD] 6y 6mo [3y 4mo]; median 5y 7mo, range 1-19y). Absolute interrater agreement among professionals was 86% (weighted $\kappa=0.88$; 95% confidence interval [CI] 0.83-0.93). Test-retest reliability was high (weighted $\kappa=0.97$; 95% CI 0.95-0.99). Parent-professional interrater reliability on 39 children was moderate (weighted $\kappa=0.51$; 95% CI 0.39-0.63). **INTERPRETATION:** The VFCS has been appropriately constructed and provides a reliable system to classify visual abilities of children with CP both in clinical and in research settings.

PMID: [31180136](#)

18. Construct Validity of the Viking Speech Scale.

Pennington L, Hustad KC.

Folia Phoniatr Logop. 2019 Jun 12:1-10. doi: 10.1159/000499926. [Epub ahead of print]

OBJECTIVE: The Viking Speech Scale (VSS) reliably classifies the speech performance of children with cerebral palsy. This paper aims to establish the construct validity of the VSS by testing the extent to which percentage intelligibility in single word speech and connected speech predicts VSS rating. **PATIENTS AND METHODS:** This is a secondary analysis of two sets of anonymised data collected for previous research. The full data set comprised 79 children with cerebral palsy from the US (n = 43) and the UK (n = 36): (43 boys, 36 girls); mean age 7.2 years (SD 3.3). Single word intelligibility was measured using the TOCS+ words for US children and Children's Speech Intelligibility Measure for the UK children. Connected speech intelligibility was measured from a subset of repeated sentences in TOCS+ for US children and picture description for the UK children. We used ordinal logistic regression to examine prediction of VSS rating by percentage single word and connected speech intelligibility scores in both samples. **RESULTS:** Percentage single word intelligibility and connected speech intelligibility predicted VSS rating in univariate and multivariate regression models for both the US and UK samples. **CONCLUSION:** Intelligibility predicts VSS for both single words and connected speech, establishing the construct validity of VSS.

PMID: [31189170](#)

19. Comparison of bispectral index values and depth of sedation during deep sedation using sevoflurane anesthesia in healthy children versus children with cerebral palsy.

Onal P, Oztas N, Kip G.

Niger J Clin Pract. 2019 Jun;22(6):801-805. doi: 10.4103/njcp.njcp_553_18.

Background: Patients with cerebral palsy (CP) are at significant risk by means of periodontal disease and tooth decay. Pharmacological techniques that require intensive care such as sedation and general anesthesia are generally used for dental treatment of this patient group. **Aim:** The purpose of this retrospective study was to compare bispectral index (BIS) values and depth of sedation recorded during deep sedation protocols performed for healthy children and children with CP in the Department of Pediatric Dentistry, Faculty of Dentistry, Gazi University.

Materials and Methods: The measurements of BIS and hemodynamic variables recorded during treatment of 26 healthy children and 26 children with CP between 3 and 10 years of age who were treated under sevoflurane and 50% N₂O-50% O₂ mixture deep sedation method were investigated retrospectively. **Results:** The mean BIS values in the CP group was statistically lower at all the time points when compared with the control group ($P < 0.001$). While there was no statistically significant difference between groups in terms of duration of treatment ($P = 0.657$), the median recovery time in the CP group was significantly longer than that recorded in the control group ($P < 0.001$). Significant correlation was found between modified Ramsay Sedation Scale (mRSS) scores and BIS levels at 5th, 10th, and 20th min in the control group ($P < 0.001$). Similar correlation was found in the CP group at 15th and 20th min. **Conclusion:** We concluded that it is necessary to consider the dosage and effect mechanisms of drugs used in children with CP to prevent overuse of anesthetics and emergence of anesthesia-related complications.

PMID: [31187765](#)

20. The effect of cerebral palsy on neonatal line thickness and enamel components.

Hershkovitz F, Shirley L, Cohen O, Zilberman U.

Arch Oral Biol. 2019 Jun 4;104:119-122. doi: 10.1016/j.archoralbio.2019.06.001. [Epub ahead of print]

OBJECTIVE: The aim of the study was to compare the neonatal line width as well as the composition of the pre-natal and post-natal enamel in deciduous teeth of children with cerebral palsy (CP) to deciduous teeth of healthy children. **DESIGN:** 58 extracted or normally exfoliated deciduous teeth were collected for the study, 29 teeth from children with cerebral palsy and 29 pair matched teeth from healthy children who served as controls. The teeth were cut along the bucco-lingual/palatal axis and polished up to a thickness of 50-100 microns. The sections were examined using a light microscope and scanning electron microscope (SEM). The neonatal line was identified in 25 teeth and measured in width and the enamel concentrations of calcium, phosphorus, silicon, magnesium, sodium, oxygen, and carbon were measured in the pre-natal and post-natal enamel using ESD program. **RESULTS:** The neonatal line was significantly narrower in the deciduous teeth collected from children with cerebral palsy. In both groups, the concentration of magnesium and sodium in the pre-natal enamel was significantly higher than in the post-natal enamel. Magnesium and sodium levels were significantly higher in pre-natal enamel in the CP group compared to the pre-natal enamel of the control group. **CONCLUSIONS:** The neonatal line was narrower in the deciduous teeth collected from children with cerebral palsy than in those collected from healthy children. Children with cerebral palsy have a higher concentration of magnesium and sodium in the enamel that developed before birth.

PMID: [31181410](#)

21. Pediatric Massage Therapy Research: A Narrative Review.

Field T.

Children (Basel). 2019 Jun 6;6(6). pii: E78. doi: 10.3390/children6060078.

This narrative review on pediatric massage literature from the last decade suggests that massage therapy has positive effects on several pediatric conditions. These include preterm infant growth, psychological problems including aggression, gastrointestinal problems including constipation and diarrhea, painful conditions including burns and sickle cell, muscle tone disorders including cerebral palsy and Down syndrome, and chronic illnesses including diabetes, asthma cancer, and HIV. Potential underlying mechanisms for the massage therapy effects include increased vagal activity and decreased stress hormones. Limitations of the literature include the need for more randomized controlled trials, longitudinal studies, and underlying mechanism studies.

PMID: [31174382](#)

22. Which growth parameters can affect mortality in cerebral palsy?

Kim HJ, Kang TU, Park KY, Kim J, Ahn HS, Yim SY.

PLoS One. 2019 Jun 14;14(6):e0218320. doi: 10.1371/journal.pone.0218320. eCollection 2019.

BACKGROUND: The objective of this study was to identify growth parameters that can affect mortality of cerebral palsy (CP). **METHOD:** This was a birth cohort study based on the National Health Screening Program for Infants and Children database along with the National Health Insurance Service, which were linked using a personal identifier number. The birth cohort consisted of 2 191 956 subjects, representing 93.5% of live births from 2007-2011, with maximal 10-year follow-up (range, 5-10 years) until October 2016. Subjects with CP were identified. Growth parameters in terms of birth weight, underweight (weight-for-age below the 3rd percentile), rate of body weight gain were collected, along with all-cause mortality after the age of 1 year. **RESULT:** Prevalence of CP was 2.0 per 1000 live births (95% CI, 1.94-2.06). All-cause mortality after the age of 1 year was 0.09 deaths/1000 person-years (95% CI, 0.08-0.09) in the general population (GP) and 2.85 deaths/1000 person-years (95% CI, 2.32-3.50) in subjects with CP during the follow-up. Therefore, the incidence rate ratio for all-cause mortality was 32.15 (95% CI, 25.72-39.76) in subjects with CP compared to GP. Presence of underweight was significantly associated with higher mortality in both subjects with CP and GP, where the adjusted hazard ratio of death was 2.60 (95% CI, 1.93-3.50) at the age of 18-24 months, 3.12 at 30-36 months, 4.37 at 42-48 months, 5.12 at 54-60 months, and 4.17 at 66-71 months. Birth weight did not affect mortality in both subjects with CP and GP after the age of 1 year ($p > 0.05$). **CONCLUSION:** While subjects with CP shows higher mortality, underweight is an important growth parameter that affects all-cause mortality of both subjects with CP and GP. This study urges increased awareness that subjects with CP who are underweight require special care.

PMID: [31199836](#)

23. Can neuromodulation techniques optimally exploit cerebello-thalamo-cortical circuit properties to enhance motor learning post-stroke?

Israely S, Leisman G.

Rev Neurosci. 2019 Jun 5. pii: /j/revneuro.ahead-of-print/revneuro-2019-0008/revneuro-2019-0008.xml. doi: 10.1515/revneuro-2019-0008. [Epub ahead of print]

Individuals post-stroke sustain motor deficits years after the stroke. Despite recent advancements in the applications of non-invasive brain stimulation techniques and Deep Brain Stimulation in humans, there is a lack of evidence supporting their use for rehabilitation after brain lesions. Non-invasive brain stimulation is already in use for treating motor deficits in individuals with Parkinson's disease and post-stroke. Deep Brain Stimulation has become an established treatment for individuals with movement disorders, such as Parkinson's disease, essential tremor, epilepsy, cerebral palsy and dystonia. It has also been utilized for the treatment of Tourette's syndrome, Alzheimer's disease and neuropsychiatric conditions such as obsessive-compulsive disorder, major depression and anorexia nervosa. There exists growing scientific knowledge from animal studies supporting the use of Deep Brain Stimulation to enhance motor recovery after brain damage. Nevertheless, these results are currently not applicable to humans. This review details the current literature supporting the use of these techniques to enhance motor recovery, both from human and animal studies, aiming to encourage development in this domain.

PMID: [31194694](#)

24. Effects of salivary gland botulinum Toxin-A on drooling and respiratory morbidity in children with neurological dysfunction.

Gubbay A, Marie Blackmore A.

Int J Pediatr Otorhinolaryngol. 2019 Jun 4;124:124-128. doi: 10.1016/j.ijporl.2019.05.044. [Epub ahead of print]

OBJECTIVE: To describe the effects of salivary gland Botulinum Toxin-A (SG BoNT-A) on children with drooling due to neurological dysfunction. **METHODS:** This was a 3½-year prospective observational case series design of children referred for SG BoNT-A injections at a pediatric hospital (2010-2014). Outcomes were parent-reported severity, frequency, impact of drooling, and respiratory morbidity; and, from hospital records, number of respiratory hospital admissions.

RESULTS: Out of 17 children treated, complete data were available for 15 (including 8 boys) aged 3-14 years (Mean = 9.9 years; SD = 3.4), with a combined total of 71 injections. Most had cerebral palsy (n = 11), classified as Level V (n = 10) or IV (n = 1) on the Gross Motor Function Classification Scale (GMFCS). In almost all instances, parents reported reductions in severity, frequency, and impact of drooling, and parent-reported respiratory morbidity. Among those with posterior drooling (n = 12), most children (n = 10) did not have advanced respiratory disease. A trend towards reduced respiratory-related hospital admissions was observed during SG BoNT-A treatment periods. **CONCLUSION:** SG BoNT-A can improve severity, frequency, and impact of drooling. It can also reduce respiratory-related hospital admissions in children with posterior drooling without advanced respiratory disease. For children with advanced respiratory disease, it may reduce severity and impact of drooling.

PMID: [31185343](#)

25. Health-related quality of life and mental health of adolescents with cerebral palsy in rural Bangladesh.

Power R, Muhit M, Heanoy E, Karim T, Badawi N, Akhter R, Khandaker G.

PLoS One. 2019 Jun 11;14(6):e0217675. doi: 10.1371/journal.pone.0217675. eCollection 2019.

AIM: To assess the health-related quality of life (HRQoL) and mental health of adolescents with cerebral palsy (CP) in rural Bangladesh. **METHODS:** Case-control study of adolescents with CP (10 to ≤18-years) and age and sex matched controls without disability. Primary caregivers were included for proxy report. HRQoL was measured with Bengali versions CP Quality of Life-Teens (CPQoL-Teens) and KIDSCREEN-27. Mental health was measured with Strengths and Difficulties Questionnaire (SDQ). **RESULTS:** 154 cases and 173 controls matched on age and sex participated (mean age 15.1 (1.6) and 14.9 (1.6) respectively; female n = 48, n = 55 respectively, p>0.05). CPQoL-Teens was administered to adolescents with CP only; mean outcomes ranged from 38.5 (27.4) to 71.5 (16.1) and 'feelings about functioning' was poorest domain for both self- and proxy-report groups. KIDSCREEN-27 was administered to adolescents with CP and controls; adolescents with CP mean outcomes ranged from 25.9 (12.2) to 48.7 (10.56) and were significantly poorer than controls, mean difference 4.3 (95% CI 0.7 to 7.8) to 16.7 (95% CI 14.5 to 18.5), p<0.05. 'Peers and social support' was poorest domain for all groups. In regards to mental health, adolescents with CP reported significantly poorer mean SDQ than peers without disability, mean difference 0.7 (95% CI 0.3 to 1.1) to 7.8 (95% CI 6.7 to 8.9), p<0.05; and were for self-report 7.8 (95% CI 2.6 to 23.0) and proxy-report 12.0 (95% CI 6.9 to 20.9) times more likely to report 'probable' range 'total difficulties' score. Individual item analysis of CPQoL-Teens and KIDSCREEN-27 identified unique areas of concern for adolescents with CP related to pain, friendships, physical activity and energy, what may happen later in life, and feelings about having CP. Financial resources were of concern for both cases and controls.

PMID: [31185015](#)

26. Quality of life in children and adolescents with cerebral palsy: a systematic review with meta-analysis.

Makris T, Dorstyn D, Crettenden A.

Disabil Rehabil. 2019 Jun 10;1-10. doi: 10.1080/09638288.2019.1623852. [Epub ahead of print]

Background: Cerebral palsy has been linked to decreased quality of life. However use of self- versus proxy-perspectives and norm-sample comparisons to examine quality of life impact may produce different results. **Aims:** To compare quality of life ratings in children and adolescents with cerebral palsy relative to typically developing peers in consideration of sample and methodological moderators on estimated effects. **Methods:** Eleven independent studies, comprising a pooled sample of 1475 families living with cerebral palsy and 42119 peers, were identified. Study reporting quality was evaluated with the QualSyst tool and standardised mean group differences (Hedges' g) with associated confidence intervals and p values calculated. Heterogeneity was examined using a random effects model. **Results:** All studies provided good to excellent methodological and statistical detail. Physical quality of life was significantly impaired among those with cerebral palsy (g range: -0.42 to -1.58). However, inconsistent findings were noted in relation to the effect of cerebral palsy on psychological (g range: 0.04 to -0.80) and social quality of life (g range: -0.80 to -0.51), depending on the measurement used. There was a trend for parents to evaluate their child's physical quality of life lower than child-reported scores. **Conclusions:** Physical quality of life is, invariably, more affected in those with cerebral palsy. The connection between cerebral palsy and psychosocial quality of life is less clear. Noted parent-child discrepancies highlight the value of a multi-informant approach to child quality of life assessment. **Implications for rehabilitation** Quality of life is an important health-related outcome in cerebral palsy research and practice. Collecting both self-report and proxy data can help to highlight quality of life issues that are salient to the parent and to the child or adolescent with cerebral palsy. Selection of the appropriate quality of life instrument depends on the assessment purpose, with available measures varying in their focus on functionality, subjectivity and illness-specific items.

Quality of life assessment of children with cerebral palsy should extend beyond functional abilities to include less obvious, but critical, psychological and social issues.

PMID: [31180733](#)

27. The reaction to diagnosis questionnaire: a preliminary validation of a new self-report measure to assess parents' resolution of their child's diagnosis.

Sher-Censor E, Dan Ram-On T, Rudstein-Sabbag L, Watenberg M, Oppenheim D.

Attach Hum Dev. 2019 Jun 11:1-16. doi: 10.1080/14616734.2019.1628081. [Epub ahead of print]

Parents' resolution of their child's diagnosis is associated with parental sensitivity and secure child attachment. The Reaction to Diagnosis Interview (RDI) is the accepted measure for assessing resolution, but its administration and coding are time and labor intensive. This study examined the psychometric properties of the Reaction to Diagnosis Questionnaire (RDQ), a new self-report measure that assesses resolution. 75 mothers of children diagnosed with Cerebral Palsy or Developmental Delay completed the RDI and the RDQ and reported on family characteristics. The RDQ showed good internal consistency. Mothers who were classified as resolved using the RDI had higher RDQ scores compared with mothers who were classified as unresolved. The networks of associations of the RDI and the RDQ with family characteristics were similar, although formal equivalence testing could not be performed. The RDQ may be a promising time- and cost-effective tool. Nevertheless, more research is needed to further establish its validity.

PMID: [31184278](#)

28. Wharton's Jelly Mesenchymal Stem Cell Administration Improves Quality of Life and Self-Sufficiency in Children with Cerebral Palsy: Results from a Retrospective Study.

Boruckowski D, Zdolińska-Malinowska I.

Stem Cells Int. 2019 May 2;2019:7402151. doi: 10.1155/2019/7402151. eCollection 2019.

The aim of this paper was to describe the outcome of the therapeutic administration of allogenic mesenchymal stem cells obtained from Wharton's jelly (WJ-MSCs) in children with cerebral palsy (CP) during a medical therapeutic experiment. We retrospectively analyzed the records of 109 patients recruited in daily clinical practice. Each patient received 1-10 injections and was examined by the same neurologist (study investigator (SI)) on the day of each infusion. The SI used a 6-point Likert scale to assess the quality of life (QoL) and self-sufficiency of the patients on the basis of the neurological examination. Children with >50% follow-ups after this administration were included into the quantitative analysis. In addition, the assessments of the parents and other health care professionals were obtained for 23 patients and compared with those of the SI. Forty-eight of 54 analyzed patients (88.9%) achieved some improvement in health status. Forty-eight (88.9%) patients experienced an increase in their QoL, and 21 patients (38.9%) achieved an increase in their self-sufficiency level. Improvement was achieved in 17 areas. Adverse events were mild and temporary except one case of epilepsy deterioration leading to treatment discontinuation. Age, body mass, and cell dose were not significant predictors of QoL response, contrary to epilepsy; developmental breakthrough was dose-dependent.

PMID: [31191683](#)

29. Mobility and self-care trajectories for individuals with cerebral palsy (aged 1-21 years): a joint longitudinal analysis of cohort data from the Netherlands and Canada.

Smits DW, Gorter JW, Riddell CA, Voorman JM, Rosenbaum PL, Palisano RJ, Walter SD, Hanna SE, van Wely L, Ketelaar M.

Lancet Child Adolesc Health. 2019 Jun 6. pii: S2352-4642(19)30122-1. doi: 10.1016/S2352-4642(19)30122-1. [Epub ahead of print]

BACKGROUND: A good understanding of developmental trajectories is crucial for making prognoses, planning interventions, and monitoring progress in children and adolescents with cerebral palsy. Our study aimed to describe developmental trajectories of mobility and self-care capability in a large sample of children and adolescents with cerebral palsy from the Netherlands and Canada. **METHODS:** We did longitudinal data analyses of cohorts from the Netherlands (Pediatric Rehabilitation Research in the Netherlands; PERRIN) and Ontario, Canada (Adolescent Study of Quality of Life, Mobility, and Exercise; ASQME). All participants had a confirmed diagnosis of cerebral palsy and ranged in age from 1 year to 17 years at baseline, and were recruited from rehabilitation centres and university medical centres. Individuals diagnosed with additional conditions affecting motor function other than cerebral palsy (eg, spina bifida or muscle diseases) were excluded. After baseline assessment, up to three follow-up assessments were done at 1 year intervals. The whole spectrum of severity of cerebral palsy was represented in terms of motor function, using the Gross Motor Function Classification System (GMFCS). Mobility and self-care capability were assessed with the Pediatric Evaluation of Disability Inventory (PEDI). We applied non-linear mixed-effects modelling to estimate limits, rates, and variations of development. **FINDINGS:** For both projects, recruitment took place between 2002 and 2007. The combined dataset included 551 individuals with cerebral palsy (321 individuals from the PERRIN programme and 230 from ASQME), aged 1 year to 17 years at baseline, with longitudinal data available for up to 4 years. On the basis of a total of 1754 PEDI observations, we created developmental curves for ages 1-21 years. Both for mobility and self-care, limits and rates of development differed among individuals across GMFCS levels, resulting in distinct curves. For individuals classified as being in GMFCS level I, the estimated mean limit for mobility and self-care were both higher than 90 (95·6, 95% CI 94·5-96·7 for mobility and 91·8, 90·1-93·4 for self-care), indicating capability for most if not all items on the PEDI. By comparison, the estimated mean limits for children in levels II-V varied from 83·0 (80·3-85·7) to 23·6 (20·7-26·4), with increasing limitations in mobility and self-care capability for higher GMFCS levels. Individuals with lower GMFCS levels (ie, less severe cerebral palsy) showed higher developmental limits that were reached during a longer period of development. However, among individuals within the same GMFCS level, we found substantial interindividual variation in development for mobility, and even more so for self-care.

PMID: [31178370](#)

30. Neurodevelopmental Treatment (Bobath) for Children With Cerebral Palsy: A Systematic Review.

Zanon MA, Pacheco RL, Latorraca COC, Martimbianco ALC, Pachito DV, Riera R.

J Child Neurol. 2019 Jun 10:883073819852237. doi: 10.1177/0883073819852237. [Epub ahead of print]

AIM: To assess the effects of neurodevelopmental treatment for children with cerebral palsy. **METHODS:** We conducted a systematic review following the recommendations of the Cochrane Handbook for Systematic Reviews of Interventions and reported in accordance to PRISMA Statement. Through a comprehensive literature search we considered all randomized clinical trials that compared neurodevelopmental treatment with conventional physical therapy for children with cerebral palsy. We used the Cochrane Risk of Bias Table to assess the risk of bias of the included randomized clinical trial, and the GRADE approach to evaluate the certainty of the body of the evidence. **RESULTS:** We found 3 randomized clinical trials (2 published and 1 ongoing) comprising 66 children. Published randomized clinical trials presented methodological and reporting limitations and only 1 provided data for outcomes of interest. No difference between neurodevelopmental treatment and conventional physical therapy was found for gross motor function (mean difference 1.40; 95% confidence interval -5.47 to 8.27, low certainty evidence). **CONCLUSION:** This review found that the effects of neurodevelopmental treatment for children with cerebral palsy are still uncertain. Further studies are required to assess the efficacy and safety of neurodevelopmental treatment for this purpose and until there, current evidence do not support its routinely use in practice. Number of protocol registration in PROSPERO database: CRD42017082817 (available from https://www.crd.york.ac.uk/prospéro/display_record.php?RecordID=82817).

PMID: [31179823](#)

31. Barriers to recruitment of children with cerebral palsy in a trial of home-based training.

Beckers LWME, Rameckers EAA, Smeets RJEM, van der Burg JJW, Aarts PBM, Schnackers MLAP, Janssen-Potten YJM.

Contemp Clin Trials Commun. 2019 May 2;15:100371. doi: 10.1016/j.conctc.2019.100371. eCollection 2019 Sep.

Many trials fail to include the targeted number of participants, causing scientific and ethical problems. The COAD trial of home-based training programs (HBTPs) for children with unilateral cerebral palsy (CP) encountered recruitment problems, even though the parent-delivered home-based approach complies with recent health-care developments in the Netherlands. The current project aimed to identify the barriers to recruitment in the COAD trial. This summative, multidimensional evaluation comprised informal conversational interviews in which stakeholders who had been involved reflected on the factors that impeded successful recruitment of participants into the COAD trial. Barriers to implementation and recruitment were clustered according to the constructs of the Consolidated Framework for Implementation Research (CFIR). Member checking validated the findings. A total of 41 stakeholders contributed to the evaluation. Barriers to the implementation of the HBTPs were identified within every domain of the CFIR (intervention characteristics, outer setting, inner setting, characteristics of individuals, and process). Parent-delivered home-based training was perceived as highly complex and in conflict with the pressures on and the needs of parents. Many parents preferred the alternative center-based group interventions. The involvement of a resonance group was highly valued, and opportunities for further enhancements emerged. Additionally, the importance of research consortia was emphasized. The appropriateness of the RCT as the study design was criticized. The findings of this study are summarized in a tool which provides a dozen directions for the successful recruitment of participants in pediatric rehabilitation research.

PMID: [31198879](#)

32. Neural Plasticity after Congenital Brain Lesions.

Fiori S, Staudt M, Boyd RN, Guzzetta A.

Neural Plast. 2019 May 2;2019:9154282. doi: 10.1155/2019/9154282. eCollection 2019.

PMID: [31191640](#)

33. Empyema necessitatis due to *Pseudomonas aeruginosa* in a child with cerebral palsy.

Nishimura A, Yamaguchi H, Ito Y, Tokumoto S, Toyoshima D, Kasai M, Maruyama A.

J Infect Public Health. 2019 Jun 5. pii: S1876-0341(19)30181-9. doi: 10.1016/j.jiph.2019.05.013. [Epub ahead of print]

Empyema necessitatis (EN) is a rare complication of empyema in which the pleural infection spreads outside the pleural space. Lower airway infections are common among children with cerebral palsy (CP). Although harmless to healthy individuals, *Pseudomonas aeruginosa* can cause invasive infections, including CP, in immunocompromised hosts. *Mycobacterium tuberculosis* and *Actinomyces* spp. have been reported as common causative organisms of EN. However, EN caused by *P. aeruginosa* has never been reported. We report the case of an 8-year-old girl with CP without tracheotomy who was admitted to our hospital with complaints of fever and increased epileptic seizures. First, she was diagnosed with pneumonia and treated with antibiotics. However, seven days after admission, a palpable mobile mass overlying the lower part of the shoulder blade was noticed. Enhanced magnetic resonance imaging revealed broad high signal area on T2-weighted and diffusion-weighted images, indicating empyema of the left lower lung that had penetrated the pleural wall and spread to the subcutaneous area of the left back. Thus, she was diagnosed with EN. Twelve days after admission, *P. aeruginosa* was detected from the pus culture. Patients with CP who have chronic lung diseases, such as pneumonia, atelectasis, or empyema, may need careful follow up.

PMID: [31176605](#)

Prevention and Cure

34. Sex-specific maternofetal innate immune responses triggered by group B Streptococci.

Allard MJ, Giraud A, Segura M, Sebire G.

Sci Rep. 2019 Jun 13;9(1):8587. doi: 10.1038/s41598-019-45029-x.

Group B Streptococcus (GBS) is one of the most common bacteria isolated in human chorioamnionitis, which is a major risk factor for premature birth and brain injuries. Males are at greater risk than females for developing lifelong neurobehavioural disorders, although the origins of this sex bias remain poorly understood. We previously showed that end-gestational inflammation triggered by GBS led to early neurodevelopmental impairments mainly in the male rat progeny. Identifying key inflammatory players involved in maternofetal immune activation by specific pathogens is critical to develop appropriate novel therapeutic interventions. We aimed to map out the GBS-induced profile of innate immune biomarkers in the maternal-placental-fetal axis, and to compare this immune profile between male and female tissues. We describe here that the GBS-induced immune signalling involved significantly higher levels of interleukin (IL)-1 β , cytokine-induced neutrophil chemoattractant-1 (CINC-1/CXCL1) and polymorphonuclear cells (PMNs) infiltration in male compared to female maternofetal tissues. Although male - but not female - fetuses presented increased levels of IL-1 β , fetuses from both sexes in-utero exposed to GBS had increased levels of TNF- α in their circulation. Levels of IL-1 β detected in fetal sera correlated positively with the levels found in maternal circulation. Here, we report for the first time that the maternofetal innate immune signalling induced by GBS presents a sexually dichotomous profile, with more prominent inflammation in males than females. These sex-specific placental and fetal pro-inflammatory responses are in keeping with the higher susceptibility of the male population for preterm birth, brain injuries and neurodevelopmental disorders such as cerebral palsy and autism spectrum disorders.

PMID: [31197179](#)

35. GNAO1 mutation presenting as dyskinetic cerebral palsy.

Malaquias MJ, Fineza I, Loureiro L, Cardoso L, Alonso I, Magalhães M.

Neurol Sci. 2019 Jun 12. doi: 10.1007/s10072-019-03964-7. [Epub ahead of print]

PMID: [31190250](#)

36. Occurrence of and temporal trends in fidgety general movements in infants born extremely preterm/extremely low birthweight and term-born controls.

Kwong AKL, Olsen JE, Eeles AL, Einspieler C, Lee KJ, Doyle LW, Cheong JLY, Spittle AJ.

Early Hum Dev. 2019 Jun 8;135:11-15. doi: 10.1016/j.earlhumdev.2019.05.018. [Epub ahead of print]

BACKGROUND: Fidgety general movements have high predictive validity for later cerebral palsy (CP) but their temporal organisation requires further understanding for assessment accuracy. **AIMS:** To describe the occurrence of and temporal trends in fidgety movements, and whether they differ between infants born preterm and at term. **SUBJECTS:** We assessed 155 EP/ELBW infants and 185 term-born infants born extremely preterm (EP; <28 weeks' gestation) and/or extremely low birthweight (ELBW; <1000 g birthweight) or at term (37-42 weeks' gestation) in the state of Victoria, Australia. **OUTCOME MEASURES:** Parents of infants submitted up to two videos at 12-13+6 and/or 14-16+6 weeks' corrected age of infants' general movements. Videos were scored using the Prechtl General Movements Assessment (GMA) (fidgety) and classified as normal or absent/abnormal. Infants with at least one normal GMA were classified as normal. Individual GMA trajectories were analysed over time using logistic regression. **RESULTS:** Overall, infants born EP/ELBW were more likely to have absent/abnormal fidgety movements than term-born infants (23% versus 3%, odds ratio [OR] 8.50 (95% confidence interval (CI) 3.48-20.8, $p < 0.001$). Fewer EP/ELBW and term-born infants showed absent/abnormal fidgety movements with each week of increasing age (EP/ELBW OR 0.46, 95% CI 0.25-0.84, $p = 0.01$; term-born OR 0.35, 95% CI 0.16-0.8, $p = 0.01$; interaction, $p = 0.53$). **CONCLUSIONS:** Absent/abnormal fidgety movements are more prevalent in infants born EP/ELBW than at term. Fidgety movements normalise with older age in both infants born EP/ELBW and at term between 12 and 16+6 weeks' corrected age.

PMID: [31185386](#)

37. Parent-Infant Interaction during the First Year of Life in Infants at High Risk for Cerebral Palsy: A Systematic Review of the Literature.

Festante F, Antonelli C, Chorna O, Corsi G, Guzzetta A.

Neural Plast. 2019 Apr 15;2019:5759694. doi: 10.1155/2019/5759694. eCollection 2019.

Introduction: Perinatal adverse events put neonates at high risk for short and long-term disabilities, including cerebral palsy (CP). The most recent guidelines about early intervention in infants with brain damage have emphasized the importance of family involvement from the very first phases of development. Early parent-infant interactions are pivotal in promoting infant cognitive and social developmental trajectories. However, little is known about the extent to which severe adverse perinatal events can affect the quality of early parent-infant interactions. **Patients and Methods:** We systematically searched five databases (PubMed, PsycINFO, EMBASE, CINAHL, and Cochrane Library) for the publications assessing parent-infant interactions in infants at high neurological risk within 1 year of age. Articles were selected if they involved direct comparison between high-risk populations and healthy controls or low-risk populations, and if quantitative or semiquantitative tools were used to assess the parent-infant interaction. Measures of parent-infant interaction included infant interactive behaviors, parental interactive behaviors, and dyadic interactive patterns. **Results:** The search yielded 18 publications that met the inclusion criteria. The articles represent a high level of heterogeneity in terms of infant neurological risk, infant age, and tools assessing interactive behaviors. Both infant and maternal behaviors within the investigated interactive exchanges were reported to be compromised, leading to subsequent overall impairment of the dyadic patterns. **Conclusion:** While the studies reviewed here provide general and important information, the review did not yield a clear picture of early dyadic interactions in high-risk infant populations. Further observational studies are warranted in order to provide a more accurate knowledge of the early dyadic exchanges between infants at high neurological risk and their parents, as they might provide a critical opportunity for early family centered rehabilitative interventions.

PMID: [31178902](https://pubmed.ncbi.nlm.nih.gov/31178902/)