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Interventions and Management

1. Combining spinal neuromodulation and activity based neurorehabilitation therapy improves sensorimotor function in cerebral palsy

Rahul Sachdeva, Kristin Girshin, Yousef Shirkhani, Parag Gad, V Reggie Edgerton

Front Rehabil Sci. 2023 Jul 26;4:1216281. doi: 10.3389/fresc.2023.1216281. eCollection 2023.

Motor dysfunction in individuals with cerebral palsy (CP) such as the inability to initiate voluntary movements, walking with compensatory movement patterns, and debilitating spasticity is due to the aberrant neural connectivity between the brain and spinal cord. We tested the efficacy of noninvasive spinal cord neuromodulation (SCiP™, SpineX Inc.) with activity-based neurorehabilitation therapy (ABNT) in improving the sensorimotor function in six children with CP. Children received 8 weeks of either SCiP™ or sham therapy with ABNT (n = 3 per group). At the end of 8 weeks, all participants received 8 weeks of SCiP™ therapy with ABNT. Follow up assessments were done at week 26 (10 weeks after the last therapy session). Sensorimotor function was measured by the Gross Motor Function Measure 88 (GMFM88) test. We observed minimal change in sham group (mean 6% improvement), however, eight weeks of SCiP™ therapy with ABNT resulted in statistically and clinically relevant improvement in GMFM88 scores (mean 23% increase from baseline). We also observed reduced scores on the modified Ashworth scale only with SCiP™ therapy (-11% vs. +5.53% with sham). Similar improvements were observed in sham group but only after the cross over to SCiP™ therapy group at the end of the first eight weeks. Finally, sixteen weeks of SCiP™ therapy with ABNT resulted in further improvement of GMFM88 score. The improvement in GMFM88 scores were maintained at week 26 (10 weeks after the end of therapy), suggesting a sustained effect of SCiP™ therapy.

PMID: [37565185](https://pubmed.ncbi.nlm.nih.gov/37565185/)

2. sPinal cOrd neUromodulation to treat Cerebral palsy in pEdiatrics: POUNCE Multisite Randomized Clinical Trial

Kristin Girshin, Rahul Sachdeva, Richard Cohn, Parag Gad, Andrei V Krassioukov, V Reggie Edgerton

Front Neurosci. 2023 Jul 26;17:1221809. doi: 10.3389/fnins.2023.1221809. eCollection 2023.

Introduction: Cerebral palsy (CP) affects up to 4 children in 1,000 live births, making it the most common motor disorder in children. It impairs the child's ability to move voluntarily and maintain balance and posture, and results in a wide range of other functional disorders during early development impairments in various sensory modalities, e.g., vision, hearing ability and proprioception. Current standard of care therapy focuses on symptom management and does not mitigate the progression of many of these underlying neurological impairments. The goal of this trial is to conduct a prospective multicenter, double-blinded, sham-controlled, crossover, randomized control trial to demonstrate the safety and efficacy of noninvasive spinal cord neuromodulation (SCiP™, SpineX Inc.) in conjunction with activity-based neurorehabilitation therapy (ABNT) to improve voluntary sensorimotor function in children with cerebral palsy. Methods and analysis: Sixty participants (aged 2-13 years) diagnosed with CP classified as Gross Motor Function Classification Scale Levels I-V will be recruited and divided equally into two groups (G1 and G2). Both groups will receive identical ABNT 2 days/wk. G1 will initially receive sham stimulation, whereas G2 will receive therapeutic SCiP™ therapy for 8 weeks. After 8 weeks, G1 will cross over and receive therapeutic SCiP™ therapy for 8 weeks, whereas G2 will continue to receive SCiP™ therapy for another 8 weeks, for a total

of 16 weeks. Primary and secondary outcome measures will include Gross Motor Function Measure-88 and Modified Ashworth Scale, respectively. Frequency and severity of adverse events will be established by safety analyses. Ethics and dissemination: The trial is registered on clinicaltrials.gov (NCT05720208). The results from this trial will be reported on clinicaltrials.gov, published in peer-reviewed journals and presented at scientific and clinical conferences.

PMID: [37564370](https://pubmed.ncbi.nlm.nih.gov/37564370/)

3. Definition of hip displacement and dislocation by acetabular dysplasia in children with cerebral palsy

Nai Kuang Wang, Shih Hsien Shen, Brian Po Jung Chen, Chia Hsieh Chang, Ken N Kuo

J Child Orthop. 2023 Jul 22;17(4):315-321. doi: 10.1177/18632521231185294. eCollection 2023 Aug.

Purpose: The acetabulum interacts with the femoral head in daily activities and may exhibit structural changes in the presence of hip disorders. This study aims to redefine hip disorders in children with cerebral palsy by structural characteristics of the acetabulum in relation to the degree of the migration percentage. **Methods:** The clinical and radiographic data of 70 patients (36 males, 34 females; mean age 8.2 years) with spastic cerebral palsy were retrospectively analyzed. The acetabular structure was measured by the acetabular index on reconstructed three-dimensional computerized tomography for precision of measurement. Any significant change in acetabular index measured on the reconstructive computerized tomography related to every 10% increment of migration percentage was regarded as clinically significant in hip disorders. **Results:** The acetabular index measured on the reconstructive computerized tomography showed an increasing trend with the increment of migration percentage. The most significant acetabular index measured on the reconstructive computerized tomography change occurred between the 20%-29% and 30%-39% migration percentage groups ($p < 0.001$), suggesting that a migration percentage of 30% is the starting point of hip disorder. A significant increase in the posterolateral acetabular index measured on the reconstructive computerized tomography occurred in migration percentages $>50\%$, indicating posterolateral acetabular dysplasia. Hips with migration percentages from 80% to 100% had consistent acetabular indexes measured on the reconstructive computerized tomography values, suggesting complete dislocation and no more contact and interaction between the femoral head and acetabular fossa. **Conclusion:** Structural characteristics in the acetabulum reflect hip dysfunction and potentially classify hip disorders. Results suggest the migration percentage 30% as a starting point of hip disorder and 80% as a turning point of hip dislocation in children with cerebral palsy. Level of evidence: level IV, diagnostic study.

PMID: [37565006](https://pubmed.ncbi.nlm.nih.gov/37565006/)

4. Validation of a modified Care and Comfort Score and responsiveness to hip surgery in children with cerebral palsy in Gross Motor Function Classification System levels IV and V

Navnit S Makaram, Robin J Prescott, Phyllida Alexander, James E Robb, Mark S Gaston

Bone Jt Open. 2023 Aug 10;4(8):580-583. doi: 10.1302/2633-1462.48.BJO-2023-0051.R1.

Aims: The purpose of this study was to assess the reliability and responsiveness to hip surgery of a four-point modified Care and Comfort Hypertonicity Questionnaire (mCCHQ) scoring tool in children with cerebral palsy (CP) in Gross Motor Function Classification System (GMFCS) levels IV and V. **Methods:** This was a population-based cohort study in children with CP from a national surveillance programme. Reliability was assessed from 20 caregivers who completed the mCCHQ questionnaire on two occasions three weeks apart. Test-retest reliability of the mCCHQ was calculated, and responsiveness before and after surgery for a displaced hip was evaluated in a cohort of children. **Results:** Test-retest reliability for the overall mCCHQ score was good (intraclass correlation coefficient 0.78), and no dimension demonstrated poor reliability. The surgical intervention cohort comprised ten children who had preoperative and postoperative mCCHQ scores at a minimum of six months postoperatively. The mCCHQ tool demonstrated a significant improvement in overall score from preoperative assessment to six-month postoperative follow-up assessment ($p < 0.001$). **Conclusion:** The mCCHQ demonstrated responsiveness to intervention and good test-retest reliability. The mCCHQ is proposed as an outcome tool for use within a national surveillance programme for children with CP.

PMID: [37558227](https://pubmed.ncbi.nlm.nih.gov/37558227/)

5. [Hip joint status in adult patients with cerebral palsy] [Article in Spanish]

E Toro Tamargo, D Pedrera Mulero, M Meléndez Plumed

Rehabilitacion (Madr). 2023 Aug 3;57(4):100811. doi: 10.1016/j.rh.2023.100811. Online ahead of print.

Introduction: In cerebral palsy, femoral head migration is defined as the loss of coverage of the femoral head by the acetabulum and is measured using the Reimer index. Surgical treatment can be preventive, reconstructive, or salvage, and failure rates of surgery are high and related to the severity of cerebral palsy. The aim of our work is to assess the incidence of hip migration in our series of adult patients with cerebral palsy, to determine the outcome of those who have undergone surgery, and to establish

recurrence rates after the various surgical techniques. **Material and methods:** We designed a retrospective observational study to determine the hip status of adult patients with cerebral palsy visiting the Unit between 2008 and 2021. **Results:** The overall incidence of hip displacement was 75%, patients with more extensive disability (GMFCS IV and V) were more predisposed to dislocation, also more severe. Soft tissue surgery made up 49.5% of the operations performed with a failure rate of up to 82%. Reconstructive surgery was performed in 45.5% of cases with a failure rate of more than 86%. **Conclusion:** The current hip surveillance programmes have been implemented to improve follow-up and interventions in hip displacement, with the objective of maintaining optimal acetabular coverage and reducing the failure rate of potential surgeries.

PMID: [37542743](#)

6. Robust deep learning-based gait event detection across various pathologies

Bernhard Dumphart, Djordje Slijepcevic, Matthias Zeppelzauer, Andreas Kranzl, Fabian Unglaube, Arnold Baca, Brian Horsak

PLoS One. 2023 Aug 11;18(8):e0288555. doi: 10.1371/journal.pone.0288555. eCollection 2023.

The correct estimation of gait events is essential for the interpretation and calculation of 3D gait analysis (3DGA) data. Depending on the severity of the underlying pathology and the availability of force plates, gait events can be set either manually by trained clinicians or detected by automated event detection algorithms. The downside of manually estimated events is the tedious and time-intensive work which leads to subjective assessments. For automated event detection algorithms, the drawback is, that there is no standardized method available. Algorithms show varying robustness and accuracy on different pathologies and are often dependent on setup or pathology-specific thresholds. In this paper, we aim at closing this gap by introducing a novel deep learning-based gait event detection algorithm called IntellEvent, which shows to be accurate and robust across multiple pathologies. For this study, we utilized a retrospective clinical 3DGA dataset of 1211 patients with four different pathologies (malrotation deformities of the lower limbs, club foot, infantile cerebral palsy (ICP), and ICP with only drop foot characteristics) and 61 healthy controls. We propose a recurrent neural network architecture based on long-short term memory (LSTM) and trained it with 3D position and velocity information to predict initial contact (IC) and foot off (FO) events. We compared IntellEvent to a state-of-the-art heuristic approach and a machine learning method called DeepEvent. IntellEvent outperforms both methods and detects IC events on average within 5.4 ms and FO events within 11.3 ms with a detection rate of $\geq 99\%$ and $\geq 95\%$, respectively. Our investigation on generalizability across laboratories suggests that models trained on data from a different laboratory need to be applied with care due to setup variations or differences in capturing frequencies.

PMID: [37566568](#)

7. Slow-motion smartphone video improves interobserver reliability of gait assessment in ambulatory cerebral palsy

Dane J Brodke, Katherine Makaroff, Enda G Kelly, Mauricio Silva, Rachel M Thompson

J Child Orthop. 2023 Jun 12;17(4):376-381. doi: 10.1177/18632521231177273. eCollection 2023 Aug.

Purpose: Structured visual gait assessment is essential for the evaluation of pediatric patients with neuromuscular conditions. The purpose of this study was to evaluate the benefit of slow-motion video recorded on a standard smartphone to augment visual gait assessment. **Methods:** Coronal and sagittal plane videos of the gait of five pediatric subjects were recorded on a smartphone, including four subjects with ambulatory cerebral palsy and one subject without gait pathology. Twenty-one video scorers were recruited and randomized to evaluate slow-motion or normal-speed videos utilizing the Edinburgh Visual Gait Score. The slow-motion group (N = 11) evaluated the videos at one-eighth speed, and the normal-speed group (N = 10) evaluated the same videos at normal speed. Interrater reliabilities were determined by calculating intraclass correlation coefficients for each group as a whole, for each Edinburgh Visual Gait Score item, and after stratification by evaluator experience level. **Results:** The slow-motion group exhibited an intraclass correlation coefficient of 0.65 (95% confidence interval: 0.58-0.73), whereas the normal-speed group exhibited an intraclass correlation coefficient of 0.57 (95% confidence interval: 0.49-0.65). For less-experienced scorers, intraclass correlation coefficients of 0.62 (95% confidence interval: 0.53-0.71) and 0.50 (95% confidence interval: 0.40-0.59) were calculated for slow motion and normal speed, respectively. For more-experienced scorers, intraclass correlation coefficients of 0.69 (95% confidence interval: 0.61-0.76) and 0.67 (95% confidence interval: 0.58-0.75) were calculated for slow motion and normal speed, respectively. **Conclusions:** Visual gait assessment is enhanced by the use of slow-motion smartphone video, a tool widely available throughout the world with no marginal cost. **Level of evidence:** level I, randomized study.

PMID: [37565008](#)

8. Addressing gross motor function by functional repetitive neuromuscular magnetic stimulation targeting to the gluteal muscles in children with bilateral spastic cerebral palsy: benefits of functional repetitive neuromuscular magnetic stimulation targeting the gluteal muscles

Leonie Grosse, Malina A Späh, Corinna Börner, Julian F Schnabel, Anne C Meuche, Barbara Parzefall, Ute Breuer, Birgit Warken, Alexandra Sitzberger, Matthias Hösl, Florian Heinen, Steffen Berweck, Sebastian A Schröder, Michaela V Bonfert

Front Neurol. 2023 Jul 26;14:1161532. doi: 10.3389/fneur.2023.1161532. eCollection 2023.

Background: Impaired selective motor control, weakness and spasticity represent the key characteristics of motor disability in the context of bilateral spastic cerebral palsy. Independent walking ability is an important goal and training of the gluteal muscles can improve endurance and gait stability. Combining conventional physical exercises with a neuromodulatory, non-invasive technique like repetitive neuromuscular magnetic stimulation probably enhances effects of the treatment. This prospective study aimed to assess the clinical effects of repetitive neuromuscular magnetic stimulation in combination with a personalized functional physical training offered to children and adolescents with bilateral spastic cerebral palsy. Methods: Eight participants Gross Motor Function Classification System level II and III ($10.4 \pm 2y5m$; 50% Gross Motor Function Classification System level II) received a personalized intervention applying functional repetitive neuromuscular magnetic stimulation (12 sessions within 3 weeks; 12,600 total stimuli during each session). At baseline and follow up the following assessments were performed: 10-m-walking-test, 6-min-walking-test, GMFM-66. Six weeks after the end of treatment the patient-reported outcome measure Gait Outcome Assessment List was completed. Results: GMFM-66 total score improved by 1.4% ($p = 0.002$), as did scoring in domain D for standing (1.9%, $p = 0.109$) and domain E for walking, jumping and running (2.6%, $p = 0.021$). Gait speed or distance walked during 6 min did not improve from baseline to follow up. Patient-reported outcome showed improvement in 4 patients in altogether 14 ratings. Caregiver-reported outcome reported benefits in 3 participants in altogether 10 ratings. Conclusion: Repetitive neuromuscular magnetic stimulation promises to be a meaningful, non-invasive treatment approach for children and adolescents with bilateral spastic cerebral palsy that could be offered in a resource-efficient manner to a broad number of patients. To further investigate the promising effects of repetitive neuromuscular magnetic stimulation and its mechanisms of action, larger-scaled, controlled trials are needed as well as comprehensive neurophysiological investigations.

PMID: [37564737](#)

9. Probability of independent walking and wheeled mobility in individuals with cerebral palsy

Suzie Noten, Katina Pettersson, Tomasz Czuba, Erika Cloudt, Jackie Casey, Elisabet Rodby-Bousquet

Dev Med Child Neurol. 2023 Aug 9. doi: 10.1111/dmcn.15731. Online ahead of print.

Aim: To estimate the probability of independent walking and wheeled mobility in individuals with cerebral palsy (CP) at home and in the community in relation to age and gross motor function. Method: This was a longitudinal cohort study using data reported into the combined Swedish CP follow-up programme and national quality registry from October 2000 to October 2022. Walking, walking with aids, wheeled mobility, and assisted mobility defined independent or assisted mobility at home and in the community, based on the Functional Mobility Scale with additional data on wheelchair performance, were assessed. Results: There were 52 858 examinations reported for 6647 individuals with CP (age range 0-32 years, follow-up period 0-22 years). Most children and adults in Gross Motor Function Classification System (GMFCS) levels I or II walked without assistive devices. The probability of dependence on others for mobility in the community was high for both children and adults in GMFCS levels III to V. Interpretation: Although independent mobility is vital for participation and social inclusion, many children and adults with CP are dependent on others for mobility. We recommend clinicians, together with families and individuals with CP, explore how to increase access to independent mobility from an early age and continuously throughout the life course.

PMID: [37559231](#)

10. Effects of the EXECP Intervention on Motor Function, Muscle Strength and Joint Flexibility in Individuals with Cerebral Palsy

Pedro Valadão, Francesco Cenni, Harri Piitulainen, Janne Avela, Taija Finni

Med Sci Sports Exerc. 2023 Aug 7. doi: 10.1249/MSS.0000000000003273. Online ahead of print.

Purpose: Numerous exercise interventions to enhance motor function in cerebral palsy (CP) have been proposed, with varying degrees of effectiveness. Since motor function requires a combination of muscle strength, joint flexibility and motor coordination, we designed a supervised multicomponent exercise intervention (EXECP) for individuals with CP. Our aim was to evaluate the effects of the EXECP intervention and its retention after it ceased. Methods: The EXECP intervention combined strength training for the lower limbs and trunk muscles, passive stretching for the lower limb muscles and inclined treadmill gait training. Eighteen participants with CP (mean age: 14, 13 males) were tested twice before the three-month intervention and

twice after the intervention, each test separated by three months. Seventeen typically developing age and sex-matched controls were tested twice. Motor function was assessed with the six minutes walking test (6MWT) and the gross motor function measure (GMFM) dimensions D and E. Passive joint flexibility was measured with goniometry. Isometric and concentric muscle strength were assessed at the knee, ankle and trunk joints. Results: The EXECP intervention successfully increased 6MWT ($p < 0.001$), GMFM ($p = 0.004$) and muscle strength for knee and trunk muscles ($p < 0.05$), although no changes were observed for ankle joint muscles. Hip and knee joint flexibility also increased ($p < 0.05$). After the retention period, all tested variables except the 6MWT and knee joint flexibility regressed and were not different from the pre-tests. Conclusions: The improvements in strength, flexibility, and possibly motor coordination brought by the EXECP intervention were transferred to significant functional gains. The regression towards baseline after the intervention highlights that training must be a life-long decision for individuals with CP.

PMID: [37565430](#)

11. Motor training for young children with cerebral palsy: A single-blind randomized controlled trial

Laura A Prosser, Samuel R Pierce, Julie A Skorup, Athylia C Paremski, Morgan Alcott, Meghan Bochnak, Noor Ruwaih, Abbas F Jawad

Dev Med Child Neurol. 2023 Aug 7. doi: 10.1111/dmcn.15729. Online ahead of print.

Aim: To compare the effect of iMOVE (Intensive Mobility training with Variability and Error) therapy with dose-matched conventional therapy on gross motor development and secondary outcomes in young children with cerebral palsy. **Method:** This single-blind, randomized controlled trial included repeated assessments of gross motor function (using the Gross Motor Function Measure) and secondary outcomes during a 12- to 24-week intervention phase and at three follow-up points after treatment. Treatment was delivered three times per week in both groups. Forty-two children aged 12 to 36 months were stratified by age and motor function to ensure equivalence between groups at baseline. Results: Thirty-six children completed treatment and follow-up phases. Treatment fidelity was high and adherence was equivalent between groups (77.3% conventional therapy, 76.2% iMOVE). There were no group differences on the primary (gross motor function after 12 weeks $p = 0.18$; after 24 weeks $p = 0.94$) or any secondary (postural control $p = 0.88$, caregiver satisfaction $p = 0.52$, child engagement $p = 0.98$) measure after treatment or at the follow-up points. However, one-third of total participants exceeded predicted change after 12 weeks and 77% exceeded predicted change after 24 weeks of treatment. **Interpretation:** Our observations indicate a potential dose-response effect of rehabilitation therapy. We further demonstrated that individual therapeutic ingredients can be manipulated. When delivered consistently, both iMOVE and conventional therapy interventions might both be more effective than standard care.

PMID: [37550991](#)

12. Is Chewing Performance Related to Dietary Intake in Children with Cerebral Palsy?

Fatih Özder, Fatma Ilgaz, Selen Serel Arslan

Dysphagia. 2023 Aug 11. doi: 10.1007/s00455-023-10612-y. Online ahead of print.

To examine the relationship between chewing performance and dietary intakes in children with Cerebral Palsy (CP). Forty children with CP aged between 2 and 6 years were included. The Karaduman Chewing Performance Scale (KCPS) and the Mastication Observation and Evaluation (T-MOE) instruments were used to evaluate chewing performance. Daily dietary intakes were measured from a 24-h food record with digital photographs including the amount and textures of all foods consumed during the meal. Chewing function was impaired in 70% of children. There was a negative low-to-moderate correlation between KCPS scores and daily protein intake ($r = -0.32$, $p = 0.04$), but not with energy and other macronutrients. The percentage of daily dietary intakes from 'liquid-blenderized' foods were positively correlated with KCPS, and negatively correlated with T-MOE scores ($p < 0.001$). There was a significant negative association between the percentage of daily dietary intakes from 'easy to chew & regular solid' foods and KCPS scores, and a significant positive association was found with T-MOE scores. In conclusion, the amount of daily protein intake decreased, and daily intake ratios of energy and macronutrients from liquid-blenderized foods increased as chewing performance decreased in children with CP. Timely diagnosis and treatment of chewing dysfunction can serve as a useful treatment option to ensure adequate dietary intake in children with CP, and also to decrease the burden of their parents and improve their quality of life.

PMID: [37566107](#)

13. Communicative and Hearing Performance in Individuals with Cochlear Implants and Delayed Neuropsychomotor Development: A Longitudinal Analysis

Larissa Veloso Rocha, Julia Speranza Zabeu-Fernandes, Rubens Vuono de Brito Neto, Marina Morettin-Zupelari, Luiz Fernando Manzoni Lourençone

Int Arch Otorhinolaryngol. 2023 Aug 4;27(3):e487-e498. doi: 10.1055/s-0042-1750765. eCollection 2023 Jul.

Introduction Between 15% to 30% of individuals with bilateral prelingual sensorineural hearing loss present with associated disabilities. Cochlear implant (CI) is an alternative treatment that provides consistent access to environmental and speech sounds, which results in significant benefits regarding quality of life and auditory and language development. **Objectives** To study the auditory and communicative performance of individuals with CI and delayed neuropsychomotor development after a minimum of five years using the device. **Methods** A total of eight patients were included in the study. We collected the multidisciplinary clinical records of participants, as well as the answers for the questionnaires applied remotely, which included the Children with Cochlear Implants: Parental Perspectives (CCIPP), International Classification of Functioning, Disability and Health: Children and Youth Version (ICF-CY), and the Gross Motor Function Classification System (GMFCS). **Results** We found that throughout the years of CI use, the auditory threshold means improved significantly in all tested frequencies, as did the speech detection threshold and the language and hearing results. Regarding parental perception, parents evaluated aspects related to their children's social relations to be positive, and had worse perceptions regarding aspects related to their education. **Conclusion** We observed a progression in the participants' auditory and language skills throughout the years of CI use; even in the presence of other associated disabilities. Future multicentric studies with larger samples are needed to further the advancement of rehabilitation in patients with other associated disabilities.

PMID: [37564470](#)

14. RELATIONSHIP BETWEEN NUTRITIONAL STATUS, DYSPHAGIA, AND FUNCTIONAL EATING LEVEL IN ADULT PATIENTS WITH CEREBRAL PALSY IN LONG INSTITUTIONAL STAYS

Luciana de Oliveira, Fabíola Darcie Marquitti, Sâmara Cunha Haddad Ramos, Eliane Aparecida de Almeida, Weslania Viviane Nascimento, Roberto Oliveira Dantas

Arq Gastroenterol. 2023 Apr-Jun;60(2):194-200. doi: 10.1590/S0004-2803.20230222-149.

Background: Diets with modified consistencies for patients with dysphagia in long term care health institutions may be associated with malnutrition. **Objective:** : To assess the nutritional status of adult patients with cerebral palsy and dysphagia hospitalized in a health institution for more than 10 years. **Methods:** : This prospective investigation was performed in 56 patients with cerebral palsy (ages 25 to 71 years, mean: 44±12 years) and no other neurological diagnosis in hospital stay for more than 10 years had their nutritional status, dysphagia, and food ingestion capacity assessed in two moments with a 12-month interval in between them, respectively using the body mass index, the dysphagia risk assessment protocol (PARD), and the functional oral ingestion scale (FOIS). **Results:** : There were no differences between December 2015 and December 2016 in the patients' weight, nutritional status, diet consistency classification, PARD, and FOIS. The limits of prescribed diet consistency (IDDSI-FDS) and the assessments of dysphagia and functional eating level influenced the nutritional status. More intense dysphagia and greater eating restrictions were associated with a worse nutritional status. **Conclusion:** : The nutritional status of adult patients with cerebral palsy hospitalized in a health long term institution who had modified diets according to their swallowing and mastication capacity did not worsen between assessments with a 12-month interval in between them. The severity of dysphagia and diet restrictions interfere with the patients' nutritional status: dysphagia and more intense eating restrictions are associated with a worse nutritional status.

PMID: [37556745](#)

15. Performance of a Mobile 3D Camera to Evaluate Simulated Pathological Gait in Practical Scenarios

Diego Guffanti, Daniel Lemus, Heike Vallery, Alberto Brunete, Miguel Hernando, Herwin Horemans

Sensors (Basel). 2023 Aug 4;23(15):6944. doi: 10.3390/s23156944.

Three-dimensional (3D) cameras used for gait assessment obviate the need for bodily markers or sensors, making them particularly interesting for clinical applications. Due to their limited field of view, their application has predominantly focused on evaluating gait patterns within short walking distances. However, assessment of gait consistency requires testing over a longer walking distance. The aim of this study is to validate the accuracy for gait assessment of a previously developed method that determines walking spatiotemporal parameters and kinematics measured with a 3D camera mounted on a mobile robot base (ROBOGait). Walking parameters measured with this system were compared with measurements with Xsens IMUs. The experiments were performed on a non-linear corridor of approximately 50 m, resembling the environment of a conventional rehabilitation facility. Eleven individuals exhibiting normal motor function were recruited to walk and to simulate gait patterns representative of common neurological conditions: Cerebral Palsy, Multiple Sclerosis, and Cerebellar Ataxia. Generalized estimating equations were used to determine statistical differences between the measurement systems and between walking conditions. When comparing walking parameters between paired measures of the systems, significant differences were found for eight out of 18 descriptors: range of motion (ROM) of trunk and pelvis tilt, maximum knee flexion in loading response, knee position at toe-off, stride length, step time, cadence; and stance duration. When analyzing how ROBOGait can distinguish simulated pathological gait from physiological gait, a mean accuracy of 70.4%, a sensitivity of 49.3%, and a specificity of 74.4% were found when compared with the Xsens system. The most important gait abnormalities related to the clinical

conditions were successfully detected by ROBOGait. The descriptors that best distinguished simulated pathological walking from normal walking in both systems were step width and stride length. This study underscores the promising potential of 3D cameras and encourages exploring their use in clinical gait analysis.

PMID: [37571727](#)

16. Imaging of developmental delay in black African children: A hospital-based study in Yaoundé-Cameroon

Seraphin Nguetack, Nasser Ndongafack Fongue, Daniel Armand Kago Tague, Ulrich Igor Mbessoh Kengne, Jean Roger Mouliom Tapouh, Félicitée Nguetack, Andreas Chiabi, Boniface Moifo

Afr Health Sci. 2023 Mar;23(1):686-692. doi: 10.4314/ahs.v23i1.73.

Background: The purpose of this study was to describe the anomalies observed on imaging for developmental delay in black African children. **Methods:** It was a descriptive cross-sectional study, which included children aged between 1 month to 6 years with developmental delay and had done a brain MRI and/or CT scan. **Results:** We included 94 children, 60.6% of whom were males. The mean age was 32.5 ± 6.8 months. A history of perinatal asphyxia found in 55.3% of cases. According to the Denver developmental II scale, profound developmental delay observed in 35.1% of cases, and severe developmental delay in 25.5%. DD was isolated in 2.1% of cases and associated with cerebral palsy, pyramidal syndrome, and microcephaly in respectively 83%, 79.8%, and 46.8% of cases. Brain CT scan and MRI accounted for 85.1% and 14.9% respectively. The tests were abnormal in 78.7% of the cases, and cerebral atrophy was the preponderant anomaly (cortical atrophy = 80%, subcortical atrophy = 69.3%). Epileptic patients were 4 times more likely to have abnormal brain imaging (OR = 4.12 and $p = 0.05$). We did not find a link between the severity of psychomotor delay and the presence of significant anomalies in imaging. **Conclusion:** In our context, there is a high prevalence of organic anomalies in the imaging of psychomotor delay, which were dominated by cerebral atrophy secondary to hypoxic ischemic events.

PMID: [37545916](#)

17. Fathers' experiences of caring for children living with cerebral palsy: A qualitative study in a low resourced socioeconomic context, Ghana

Lucy Selorm Bentum, Lillian Akorfa Ohene, Veronica Adwoa Agyare, Luke Laari, Menford Owusu Ampomah

J Pediatr Nurs. 2023 Aug 3;S0882-5963(23)00197-5. doi: 10.1016/j.pedn.2023.07.019. Online ahead of print.

Background: In Ghana, little is known about fathers' experiences caring for children with cerebral palsy. **Purpose:** The purpose of this study is to explore a. the caregiving demand and burden on fathers of children with cerebral palsy and b. describe the caregiving consequences and coping strategies of fathers of children with cerebral palsy. **Design and methods:** The study utilized an exploratory, descriptive qualitative approach with a sample size of fifteen fathers purposively selected. The study used a semi-structured interview guide to conduct a one-on-one interview with participants. The analysis performed was thematic and content analysis. **Results:** The results revealed complexities of care demand and burden; thus, meeting the child's needs resulted in physical and mental exhaustion, frequent hospital visits, and substantial financial implications for fathers. **Conclusions:** We conclude that the family, particularly fathers, need support to embrace the challenging care roles as parents to children with cerebral palsy. It is evident that caring for children is mainly reserved for mothers in the African context. However, the demanding nature of care for a child with a developmental disability requires the involvement of both parents to meet the child's care needs and reduce the caregiver's care burden. **Practice implications:** Health professionals, particularly nurses must initiate and advocate for fathers' active participation in daily childcare. Tailored supportive care for families with children with disabilities in sub-Saharan Africa is required.

PMID: [37543505](#)

18. Evaluation of daily and social participation of children with Cerebral Palsy across different age groups with a focus on the 'F'-words: Function, family, fitness, fun, friends and future

Mintaze Kerem-Günel, Umut Ece Arslan, Kübra Seyhan-Bıyık, Cemil Özal, Ayşe Numanoğlu-Akbaş, Sefa Üneş, Merve Tunçdemir, Özge Çankaya, Hilal Özcebe, Dido Green

Res Dev Disabil. 2023 Aug 8;140:104588. doi: 10.1016/j.ridd.2023.104588. Online ahead of print.

Background: The impact of disability differs across cultures. This study aimed to determine the predictors of participation in children with cerebral palsy (CP) in Turkey, based on the six F-words. **Methods:** Cross-sectional study exploring participation profiles of 450 children with CP, aged between 2 and 18 years. Pediatric Evaluation of Disability Inventory (PEDI) evaluated functional skills, and Assessment of Life Habits (LIFE-H) version 3.0 assessed daily and social participation. Hierarchical linear regression models were done to determine the predictors of participation in daily activities (PDA) and social roles (PSR)

in three age groups (2-4, 5-13 and 14-18 years) based on the 6 F-words (mobility of PEDI for 'fitness'; four classification systems and self-care of PEDI for 'functioning'; social functions of PEDI for 'friends'; demographic information by parents for 'family'; the recreation of LIFE-H for 'fun'; and different stages of development for 'future'). Results: The most important predictors for total PDA by age group were: self-care ($p = 0.012$) of PEDI in 2-4 y; self-care ($p = 0.001$) and mobility ($p = 0.005$) of PEDI in 5-13 y; GMFCS ($p = 0.006$) and mobility ($p = 0.002$) of PEDI in 14-18 y. Significant predictors for PSR differed by age group: self-care ($p = 0.001$) of PEDI in 2-4 y; self-care ($p = 0.023$) and mobility ($p = 0.006$) of PEDI in 5-13 y; and GMFCS ($p = 0.004$) and MACS ($p = 0.003$) in 14-18 y. Conclusions: Six F-words of function and fitness focussed on self-care in younger children with an increasing emphasis on mobility and ability levels according to age. Therefore, rehabilitation for different aspects of the functional levels is needed to improve participation in life across the six F-words framework; plus take into consideration context, age-differences, family's expectations, life requirements, environmental needs, and cultural differences.

PMID: [37562097](#)

19. Psychosocial correlates of neurodevelopmental disabilities in 2- to 3-year-olds

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Epilepsy Behav. 2023 Aug 7;146:109370. doi: 10.1016/j.yebeh.2023.109370. Online ahead of print.

Rationale: Canada's National Longitudinal Study of Children and Youth survey data provide insights into chronic health conditions in children. Children with neurodevelopmental disabilities (NDD) are at increased risk for adverse behavioral outcomes. Methods: We examined data from 3 cycles of Canada's National Longitudinal Survey of Children and Youth for the presence of epilepsy (Epi), cerebral palsy (CP), and intellectual disability (ID) in 2- to 3-year-olds. We then examined the relationship of NDD to composite measures of behavior: hyperactivity-inattention (HI), prosocial behaviors (PS), emotional disorder-anxiety (EA), physical aggression oppositional behavior (AO), and separation anxiety (SA). Results: There were 15 children with Epi, 25 with CP and 28 with ID in a sample of 10,879, which represented a population of 756,848 2- to 3-year-old Canadian children. Comparison of mean scores of the NDD groups and controls (Welch's ANOVA), indicated statistically significant differences in HI, PS, EA, and SA at the $p < 0.001$ level. Post hoc analysis showed significant intergroup differences. Children with epilepsy did not differ from controls on any of the behavioral measures. However, in comparison to controls, children with intellectual disability had higher EA and SA scores and lower PS scores, and those with cerebral palsy had lower PS scores. Conclusions: Children with NDD show differences in behavioral outcomes at a very early age when compared with controls. Screening for these behaviors and early intervention programs may help avoid longer term psychiatric comorbidity associated with these disabilities.

PMID: [37556967](#)

20. Selective Dorsal Rhizotomy: Patient Demographics and Postoperative Physical Therapy

Kristen Blatt, Jessica Lewis, Rachel Bican, Jeffrey Leonard

Pediatr Neurol. 2023 Jul 16;147:56-62. doi: 10.1016/j.pediatrneurol.2023.07.006. Online ahead of print.

Background: Selective dorsal rhizotomy (SDR) is a surgical procedure that permanently alters lower extremity spasticity, common in children with spastic cerebral palsy (CP). Intensive postoperative physical therapy (PT) is recommended following SDR. The first purpose of this study is to describe and compare patient demographics between children who received SDR and the population of children with CP at one institution. The second purpose of this study is to compare the completed dose of postoperative PT with the clinically recommended dose for a subset of ambulatory children who underwent SDR. Methods: This retrospective, observational study included 60 children with spastic CP following SDR. A subset ($n = 12$ ambulatory children) was included to describe the dose of postoperative PT. Information gathered from electronic medical records included age at the time of SDR, sex, Gross Motor Function Classification System level, anatomic distribution, race, county-level habitancy, health insurance provider, timed current procedural terminology codes, and location for postoperative PT encounters within a single institution. Results: Black or African American children ($P = 0.002$), children living in large central metro areas ($P = 0.033$), and children with public insurance ($P \leq 0.001$) were significantly less likely to receive SDR. Children undergoing SDR do not achieve the recommended dose of PT after hospital discharge. Conclusion: SDR is not equally accessed by patient populations, and postoperative PT frequency is below current recommendations throughout the rehabilitation process. Future studies need to investigate why these disparities exist and what prevents children from meeting the clinically recommended dose of postoperative PT after SDR.

PMID: [37556940](#)

21. Ipsilateral Motor Evoked Potentials in a Preschool-age Child With Traumatic Brain Injury: A Case Report

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Case Reports Brain Neurorehabil. 2023 Jul 27;16(2):e20. doi: 10.12786/bn.2023.16.e20. eCollection 2023 Jul.

To the best of our knowledge, the upper age limit at which post-neonatal cerebral palsy (CP) can manifest remains uncertain. This uncertainty is attributed to the lack of objective parameters for assessing the developing brain. In a previous study, we reported that an ipsilateral corticospinal projection associated with brain injury, as manifested in the paretic hand of a CP patient, had never been observed in individuals aged > 2 years. In this case report, we present an instance of ipsilateral motor evoked potential (iMEP) in a girl whose traumatic brain injury occurred at the age of 4 years. This case is the oldest in which brain injury occurred and iMEP was maintained. In conclusion, iMEP can be a valuable indicator of motor system plasticity in the developing brain.

PMID: [37554259](#)

22. Gaps in transitional care to adulthood for patients with cerebral palsy: a systematic review

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Review Childs Nerv Syst. 2023 Aug 8. doi: 10.1007/s00381-023-06080-2. Online ahead of print.

Purpose: The transition from pediatric to adult care can be complex and difficult to navigate for adolescents with cerebral palsy (CP). We aimed to assess the current state of transitional care for young persons with CP and delineate guidelines for best practice with opportunities for intervention. **Methods:** A systematic review was conducted using PRISMA guidelines to search PubMed, Embase, and Scopus databases. Articles were screened for relevance via title and abstract prior to full-text review. **Results:** Of 3151 resultant articles, 27 observational studies were included. Fourteen (52%) studies assessed clinical outcomes of patients with CP during and post-transition. Transition-associated poor outcomes included housing instability, unemployment, difficulty forming relationships, increased hospital admission rates, and decreased use of rehabilitation services. Factors associated with improved outcomes included family participation, promotion of self-efficacy, and meeting the adult team before transition. Nine (33%) studies conducted interviews with transition-age persons with CP. Key themes were a lack of transition preparedness, difficulty navigating the adult system, gaps in seamless care, and limited accessibility to specialists and environments suitable for patients with complex care needs. Four (15%) studies examined features of current transition services. Perceived barriers included poor communication within health service teams, limited adult providers accepting CP patients, and the lack of financial resources for specialized care. There was no standardized transition tool or approach. **Conclusion:** These findings underscore the importance of a planned transition process in optimizing long-term medical and psychosocial outcomes for persons with CP. Further research, including translational, team-based, and community-engaged research, are needed.

PMID: [37552305](#)

23. Clinical characteristics and long-term neurodevelopmental outcomes of leukomalacia in preterm infants and term infants: a cohort study

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J Neurodev Disord. 2023 Aug 7;15(1):24. doi: 10.1186/s11689-023-09489-7.

Background: Leukomalacia is a serious form of neonatal brain injury that often leads to neurodevelopmental impairment, and studies on neonatal leukomalacia and its long-term outcomes are lacking. The aim of this study was to analyze the clinical manifestations, imaging features, and long-term neurodevelopmental outcomes in preterm infants and term infants with leukomalacia. **Methods:** Newborns diagnosed with leukomalacia by head magnetic resonance imaging (MRI) and who were admitted to intensive care units from January 2015 to June 2020 were enrolled. All infants were followed up to June 2022 (2-7 years old), and their neurodevelopmental outcomes were evaluated. The clinical data and long-term outcomes of preterm infants and term infants was analyzed by Chi-square tests. **Results:** A total of 218 surviving infants with leukomalacia including 114 preterm infants and 104 term infants completed the follow-up. The major types of leukomalacia on MRI were periventricular leukomalacia in the preterm group and subcortical cystic leukomalacia in the term group, respectively ($\chi^2 = 55.166$; $p < 0.001$). When followed up to 2-7 years old, the incidence of neurodevelopmental impairment in the preterm group and term group was not significantly different ($\chi^2 = 0.917$; $p = 0.338$). However, the incidence of cerebral palsy (CP) in the preterm group was significantly higher ($\chi^2 = 4.896$; $p = 0.027$), while the incidence of intellectual disability (ID) ($\chi^2 = 9.445$; $p = 0.002$), epilepsy (EP) ($\chi^2 = 23.049$; $p < 0.001$), and CP combined with ID and EP ($\chi^2 = 4.122$; $p = 0.042$) was significantly lower than that in the term group. **Conclusions:** Periventricular leukomalacia mainly occurred in preterm infants while subcortical cystic leukomalacia was commonly seen in term infants. Although the long-term neurodevelopmental outcomes of leukomalacia were both poor, preterm infants were more prone to CP, while term infants were more prone to ID, EP, and the combination of CP with ID and EP.

PMID: [37550616](#)

24. "They had the lunch lady coming up to assist": The experiences of menarche and menstrual management for adolescents with physical disabilities

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Disabil Health J. 2023 Jul 20;101510. doi: 10.1016/j.dhjo.2023.101510. Online ahead of print.

Background: Menarche is a pivotal time in an adolescent's life but can be experienced differently by those with physical disabilities. Parents typically serve as the primary educators and support for their daughters during this time. Little is known about the parent's perspective of their daughter's experience preparing for menarche and learning to manage menses. Objective: We sought to understand the parent's perspective of the experience of their daughter with a physical disability around menarche and their preferences for health care provider support. Methods: Individual semi-structured interviews were conducted with 21 parents of a daughter with a physical disability ages 7-26. Interviews were coded by 2 reviewers using Grounded Theory, with disagreements resolved by consensus. Results: Six themes emerged regarding the parent's perception of the experiences, including 1) variation in emotional responses to menarche, 2) parent's perception of their daughter's experience with menses and menstrual symptoms, 3) cross-section of disability and menstrual management, 4) menstrual management at school, 5) parental knowledge correlating to daughter's preparation for menarche, and 6) desires for health care provider support. Conclusions: All parents reported that their daughters faced challenges during menarche, ranging from emotional distress to dealing with the inaccessibility of hygiene products. Managing periods at schools was particularly burdensome. Parents who were better educated about what to expect were better able to prepare their daughters, but had difficulties finding informed, supportive providers. Health care providers should provide both anticipatory guidance and holistic, respectful, and equitable options for the management of menstrual symptoms.

PMID: [37544804](#)

25. Warnings About Warnings

Atul Malhotra, Catherine Morgan

Indian Pediatr. 2023 Aug 15;60(8):619.

No abstract available

PMID: [37565435](#)