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Interventions and Management

1.Choosing the Most Appropriate Patient-Reported Outcome Measures for Hand Function: A Guide for Pediatric Hand Surgeons

Holly Cordray, Miguel Fiandero, Sarah L Struble, John R Vaile, Manisha Banala, Meagan Pehnke, Apurva S Shah, Shaun D Mendenhall

Hand (N Y). 2025 Oct 1. Online ahead of print.

Abstract

Consensus is lacking on a patient-reported outcome measure (PROM) for pediatric hand surgery; many studies use unvalidated ad-hoc surveys. To guide selection, this systematic review searched PubMed, Embase, CINAHL, and Scopus for studies evaluating hand-function-focused PROMs among pediatric patients. According to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses, reviewers independently screened studies, extracted data, assessed quality, and rated psychometrics using the Consensus-based Standards for selection of health Measurement INstruments. Content analyses used the Occupational Therapy Practice Framework, hand therapist expertise, and readability indices. Thirty-three reports on 9 PROMs were included. Existing validation covers few pediatric hand conditions, notably excluding hand trauma and nearly all congenital differences. The Upper-Extremity Cerebral Palsy Profile of Health and Function Computerized Adaptive Test (UE-CP-PRO) and ABILHAND-Kids are the strongest candidates for generating a gold-standard PROM. Both have good evidence of responsiveness to surgical outcomes. With the highest-quality validity evidence for the broadest age range, the UE-CP-PRO covers all hand function categories and relevant occupational domains; ABILHAND-Kids covers nearly all. Both failed the American Medical Association's readability standard. We provisionally recommend the UE-CP-PRO or ABILHAND-Kids for pediatric hand surgery outcomes. We encourage revising these measures and/or developing a more comprehensive PROM, incorporating adaptive condition-specific content and prioritizing readability to support child-reporting.

PMID: [41035138](#)

2. Evaluation of wrist and finger function in healthy children through music-based video game therapy

Javier Urbina-Alarcón, Ana Angulo, Victoria E Abarca, Dante A Elias

J Neuroeng Rehabil. 2025 Sep 29;22(1):198.

Abstract

The loss of hand and wrist function significantly impairs an individual's ability to perform everyday tasks, resulting in reduced independence and a lower quality of life. Neurological disorders, such as cerebral palsy, are among the leading causes of such impairments. These conditions often lead to difficulties with muscle strength, coordination, and motor control, impacting an individual's ability to manipulate objects. Cerebral palsy is a prevalent neurological disorder in children that often causes severe impairments in hand and wrist function. Traditional rehabilitation methods, such as physiotherapy, are effective but often suffer from poor adherence, especially in pediatric populations. Therefore, the use of engaging interventions, such as music-based and game-based therapies, holds significant promise for improving therapy adherence and effectiveness in children with cerebral palsy. The proposed rehabilitation system integrates a wearable data glove with a music-based serious game to promote hand and wrist function in children with neurological impairments. The data glove, equipped with two inertial measurement unit sensors, detects hand and wrist movements, serving as the primary input device for the game. The game design incorporates music therapy elements, including metronome-based rhythms and volume feedback to motivate movement and enhance neuroplasticity. Three distinct games are designed to target wrist flexion and extension, ulnar and radial deviation, and gross motor grip. Ten healthy pediatric participants completed all sessions under both music and no-music conditions. As the data were non-normal, the Wilcoxon signed-rank test was used. Statistically significant differences were found in all games, although effect sizes were small. These results suggest that music may subtly modulate motor performance. For example, in the Rocket game, music reduced variability and range of motion, suggesting more controlled wrist flexion/extension. In the Squirrel and Bubble games, music contributed to smoother movements and greater consistency in pinch grip, respectively. Usability survey data revealed high levels of user satisfaction and enjoyment, with items related to clarity, comfort, engagement, and particularly relaxation showing significant differences above neutral. This study provides exploratory evidence supporting the feasibility of music-based, game-driven rehabilitation tools in pediatric populations. Although the observed effects were modest, the system demonstrated high usability and acceptability. Future studies should include clinical populations, assess longer-term retention effects, and further investigate how music-induced relaxation may support engagement and treatment adherence in rehabilitation contexts.

PMID: [41023708](#)

3. Selective dorsal rhizotomy for spastic hemiplegic cerebral palsy

Amanda N Stanton, Mallory R Dacus, Macey Martin, Heidi Chen, Alice P Lawrence, Elizabeth N Martin, Robert P Naftel

J Neurosurg Pediatr. 2025 Oct 3:1-5. Online ahead of print.

Abstract

Selective dorsal rhizotomy (SDR) is a proven surgical treatment of spastic diplegia to improve function in patients suffering from spasticity compared to physical therapy alone. Few studies have addressed the benefit for those with spastic hemiplegia. The aim of this study was to describe and evaluate the efficacy of SDR in patients with spastic hemiplegia. A retrospective chart review was performed on pediatric patients (< 18 years of age) who underwent SDR at Monroe Carell Jr. Children's Hospital from July 2013 through January 2024 with a diagnosis of spastic hemiplegic cerebral palsy. Patients underwent pre- and postoperative physical therapy testing at approximately 1 year. Any patients found to have spastic triplegia with asymmetrical hypertonia in the lower extremities, or those without postoperative evaluations, were excluded. Outcome measures included the modified Ashworth Scale (mAS), Gross Motor Function Measure-66 (GMFM-66), timed (10 m) walk test, Gross Motor Function Classification System (GMFCS), and the Pediatric Quality of Life Cerebral Palsy (PedsQL CP) module. Pre- versus postoperative comparisons were performed using a Wilcoxon signed-rank test and the differences were considered statistically significant when p values were < 0.05. Twenty-one patients underwent SDR for spastic hemiplegic cerebral palsy with pre- and postoperative physical therapy assessments. The patients were 52.4% male, 81.0% White, with a median age of 5 years at the time of surgery. The most common etiology for spastic hemiplegia was stroke (52.4%). All patients had a preoperative GMFCS level of I (85.7%) or II (14.3%). The median percentage of rootlets cut during the procedure was 60% on the affected side. The sum of the mAS extremity score was improved by 5 points ($p < 0.001$), the GMFM-66 score was improved by a median of 3.1 ($p = 0.002$), while the PedsQL CP module improved by a median of 12.3 percentage points ($p = 0.003$). Orthotic use was reduced from 90.5% preoperatively to 66.7% at follow-up. SDR is an effective treatment in patients with spastic hemiplegia resulting in significant improvement in motor function, quality of life, and tone.

PMID: [41043185](#)

4. Reactive Balance Control Following Selective Dorsal Rhizotomy in Child With Diplegic Cerebral Palsy

Debra Depto-Hoffman, Ligia Y Mochida, Guilherme M Cesar

Clin Case Rep. 2025 Sep 28;13(10):e70975. *eCollection* 2025 Oct.

Abstract

Cerebral palsy (CP) is the most common motor disability in early childhood characterized by impaired selective motor control. Children with CP often exhibit delayed and disorganized muscle activation in response to external perturbations, resulting in a high incidence of falls and decreased participation in activities compared with their peers. We examined changes in reactive balance control post-selective dorsal rhizotomy (SDR) in a child with CP in which the major goal of this surgery is to reduce lower extremity spasticity. A 7-year-old girl with spastic diplegic CP (Gross Motor Function Classification System II) participated. Along with clinical evaluations, we employed computerized dynamic posturography to quantify changes in reactive balance control post-SDR, including the Motor Control Test and the Adaptation Test to simulate unexpected perturbations and assess the child's reactive balance control. Post-surgery evaluations indicated improved symmetry in lower extremity weight bearing, particularly in response to forward perturbations. No falls were observed post-surgery in conditions that previously caused imbalance. However, the latency response times to perturbations were longer than in typically developing peers, and the child's force to overcome induced sway was larger than her peers. Although SDR effectively decreased spasticity in our participant, it did not address other factors like soft tissue contractures, muscle weakness, and fixed biomechanical alignment constraints that contributed to balance issues in CP. To our knowledge, this is the first work that demonstrates such limitations post-SDR. The limited tools available to clinicians to assess reactive balance control in children with CP highlight the need for more effective measurements. This case report sheds light on the importance of targeted clinical approaches to enhance reactive balance control post-SDR.

PMID: [41031287](#)

5. Estimating muscle forces in patients with cerebral palsy during walking using static optimization and computed muscle control

Alina Nawab Kidwai, Kerim Atmaca, Ergin Tönük, Yunus Ziya Arslan

J Biomech Eng. 2025 Oct 4;1-53. *Online ahead of print.*

Abstract

Cerebral palsy (CP) is a group of neurological disorders that presents significant challenges for clinical rehabilitation. While muscle forces could aid clinical decision-making, direct in-vivo measurement is infeasible and ethically questionable. Consequently, model-based methods such as static optimization (SO) and computed muscle control (CMC) have gained attention. Although SO and CMC have been compared for healthy individuals, it remains uncertain whether one approach yields more accurate predictions across varying severities of crouch gait in CP. We evaluated SO and CMC using OpenSim to estimate muscle forces and activations from an openly available dataset with delineations based on crouch severity. Predicted muscle activations were validated against experimental EMG data using Spearman's rank correlation coefficients (ρ) and root-mean-squared error (RMSE), while joint moment tracking was assessed using reserve moments. A sensitivity analysis was conducted to examine the influence of tendon slack length on force predictions. Results showed that while CMC predicted generally higher muscle forces than SO, both methods yielded variable ρ values (-0.7 to 0.9) and RMSEs (0.14 to 0.7) across muscle groups and crouch severities. ρ SO was significantly higher than ρ CMC for the medial hamstrings, and crouch severity significantly influenced the ρ difference between methods for the lateral hamstrings and rectus femoris. However, RMSEs did not consistently reflect these trends. CMC was more sensitive to tendon slack length variations. Overall, neither method currently provides sufficiently validated muscle force estimates for clinical application in CP, emphasizing the need for further methodological refinement.

PMID: [41045270](#)

6. Commentary on "Task-specific Training to Improve Sitting in A Child With Severe Postural Impairments: A Single-Subject Design"

Sandra Saavedra, Rebecca Ahrns, Kendal Berning, Donna Berning

Pediatr Phys Ther. 2025 Oct 1;37(4):474. *Epub* 2025 Oct 2.

No abstract available

PMID: [41043019](#)

7.Revisiting hyper-resistance to muscle stretch in cerebral palsy: muscle hypo-extensibility is more of an issue than hyperreflexia

Pedro Valadão, Jean-Michel Gracies, Francesco Cenni, Lynn Bar-On, Harri Piitulainen, Janne M Avela, Taija Finni
J Appl Physiol (1985). 2025 Sep 30. Online ahead of print.

Abstract

Hyper-resistance to passive muscle stretch is a common debilitating symptom of spastic paresis. Although straightforward to assess, hyper-resistance is caused by a complex interaction of altered tissue properties, stretch hyperreflexia and involuntary background muscle activation. Identifying the contribution of each underlying component causing hyper-resistance is of great significance for designing treatments. The aim of this study was to investigate the components contributing to ankle plantarflexors' hyper-resistance in spastic cerebral palsy. We compared ankle biomechanical and reflex variables during ankle plantarflexors stretches at various velocities in fifteen individuals with mild spastic cerebral palsy (GMFCS I, age range: 9–22 years, 10 males) vs. fifteen age- and sex-matched typically developing controls. In addition, we evaluated associations between biomechanical and reflex variables. The cerebral palsy group had a median 9° lower maximum passive dorsiflexion range of motion at slow stretch velocity ($p = 0.001$), a 9° lower stretch reflex threshold ($p < 0.01$) with higher stretch reflex response magnitude ($p \leq 0.001$) for both soleus and medial gastrocnemius muscles, and higher peak torques at fast stretch velocities ($p < 0.01$). When normalized to the maximum passive range of motion, stretch reflex thresholds were not different between groups. While hyperreflexia directly contributed to hyper-resistance, normalized stretch reflexes did not occur earlier in the stretch in individuals with cerebral palsy compared to typically developing controls, suggesting a direct influence of muscle hypo-extensibility on hyperreflexia. Treatments for hypo-extensibility are urgently needed, more so than treatments to reduce hyperreflexia.

PMID: [41026889](#)

8.Commentary on "Validity and Reliability of Arch Height Index Measurement in Children With Spastic Diplegic Cerebral Palsy"

Jennifer Jezequel, Jasmine Tay
Pediatr Phys Ther. 2025 Oct 1;37(4):494. Epub 2025 Oct 2.

No abstract available

PMID: [41043021](#)

9.Commentary on "Aquatic Therapy Protocols on Gait of Children With Cerebral Palsy: A Randomized Controlled Clinical Trial"

Javier Güeita-Rodríguez, Johan Lambeck
Pediatr Phys Ther. 2025 Oct 1;37(4):485. Epub 2025 Oct 2.

No abstract available

PMID: [41043020](#)

10.Clinical Gait Evaluation with Neuromuscular Impairments (Clinical GENI) for spastic cerebral palsy

Kylie Clewes, Yiwen Dong, Mary Meyer, Evan Lowe, Kornél Schadt, Jessica Rose
Front Hum Neurosci. 2025 Sep 17;19:1637164. eCollection 2025.

Abstract

Background: Gait abnormalities in spastic cerebral palsy (CP) result from four primary neuromuscular impairments: muscle weakness, short muscle-relative-to-skeletal-length, muscle spasticity, and impaired selective motor control. The Clinical Gait Evaluation with Neuromuscular Impairments (Clinical GENI) was developed to help clinicians identify gait abnormalities and contributing neuromuscular impairments in spastic CP for use in any clinical setting. Aims: This study evaluated use and validity of the observational-based Clinical GENI to identify gait abnormalities and contributing neuromuscular impairments in children with spastic CP. Methods: Patients with spastic CP seen in 2023 for instrumented gait analysis and physical exam of neuromuscular impairments were evaluated using the Clinical GENI. Validity was assessed by agreement between identification of gait abnormalities on the Clinical GENI compared to 3D gait kinematics. Severity of neuromuscular impairments associated with gait abnormalities listed on the Clinical GENI was compared, and severity of neuromuscular impairment was correlated with severity of gait abnormalities. Results: Participants included 12 children with spastic CP (4 GMFCS I, 8 GMFCS II; mean age 11.25 years). The most common gait abnormalities were forefoot/flatfoot initial contact (IC) (16/24), flexed-knee IC (19/24), hip-flexion in single limb stance (12/24), and reduced pre-swing ankle plantarflexion (19/24). Strong agreement (83–100%) occurred between gait abnormalities on the Clinical GENI and kinematic values. Severity of neuromuscular impairment was higher ($p < 0.05$) for those with gait abnormalities vs. without and correlated to severity of gait abnormalities in a majority of comparisons. Conclusion: Results support clinical utility and validity of the Clinical GENI for evaluating gait abnormalities and contributing neuromuscular impairments in spastic CP.

PMID: [41041018](#)

11.Correction of Fixed Knee Flexion Deformity in Patients With Cerebral Palsy Using Suture Anchors for Anterior Distal Femur Hemi-epiphysiodesis

Mathangi Sridharan, Thomas Olson, Vanessa J Pare, Amy Steele, Nakul Talathi, Daniel Weltsch, Enda Kelly, Nicholas J Jackson, Rachel Thompson
J Pediatr Orthop. 2025 Oct 2. Online ahead of print.

Abstract

Fixed knee flexion deformity in skeletally immature patients with cerebral palsy (CP) is a common contributor to mobility impairment. Established techniques for guided growth using metal implants are associated with symptomatic hardware. This study provides early results following anterior distal femur hemi-epiphysiodesis (ADFHE) with a novel technique utilizing suture anchor-based nonmetallic implants. We reviewed a consecutive series of skeletally immature patients with CP treated for fixed knee flexion contracture with ADFHE using this novel technique between April 2021 and March 2023 at a single tertiary care hospital. All surgeries were performed by a single board-certified pediatric orthopaedic surgeon. Age at surgery, ambulatory status, Gross Motor Function Classification System (GMFCS) level, concurrent lower extremity surgery, and preoperative and postoperative knee flexion contracture (degrees) were collected. Time to resolution of contracture (months) and correction rate (degrees/month) were calculated for each knee. All patients were followed for a minimum of 6 months postoperatively (or until full correction). Descriptive statistics and time-to-event analysis were performed. Twenty-one patients were included, of whom 19 underwent bilateral correction (N=40 knees); 14 patients (26 knees) were ambulatory, and 7 patients (14 knees) were non-ambulatory. Six patients were classified as GMFCS level II (29%), 8 level III (38%), 6 level IV (29%), and 1 as level V (5%). In the ambulatory patients, preoperative knee flexion contracture measured $12.9 \pm 6.6^\circ$. Final postoperative contracture measured $1.69 \pm 4.16^\circ$. Correction occurred at a rate of $2.0^\circ/\text{month}$ over 11.9 ± 10.2 months. In the non-ambulatory patients, preoperative knee flexion contracture measured $24.6 \pm 17.4^\circ$. Final postoperative knee flexion contracture measured $13.2 \pm 12.3^\circ$. Correction occurred at a rate of $1.6^\circ/\text{month}$ over 13.5 ± 0.3 months. Correction rate ($P=0.71$) and time-to-resolution of contracture ($P=0.91$) did not differ significantly based on ambulatory status. There were no complications or symptomatic hardware necessitating removal. The use of suture anchor-based ADFHE technique for fixed knee flexion contracture is an effective technique in patients with CP, yielding results similar to those of historical techniques with a favorable complication profile.

PMID: [41037661](#)

12.Commentary on "A Qualitative Analysis of the Implementation of an Intensive Pediatric Model of Physical Therapy"

Meaghan C Rubsam, Laura Rodriguez, Jen And Greg Schmidt
Pediatr Phys Ther. 2025 Oct 1;37(4):437. Epub 2025 Oct 2.

No abstract available

PMID: [41043015](#)

13. Three-year outcomes of repeated botulinum neurotoxin A injections to the lower extremities in young children with spastic cerebral palsy in GMFCS levels I to III

Darcy Fehlings, Emma Bohn, Lauren Switzer, Charles H Goldsmith, Unni Narayanan, Peter L Rosenbaum, F Virginia Wright, Gary Foster

Dev Med Child Neurol. 2025 Oct 3. Online ahead of print.

Abstract

Aim: To evaluate the effectiveness of repeated botulinum neurotoxin A (BoNT-A) injections on gross motor function over 3 years in ambulant children with spastic cerebral palsy (CP). **Method:** A prospective observational cohort study of 124 participants was conducted comparing outcomes in children (aged 2–6 years) with spastic CP functioning in Gross Motor Function Classification System (GMFCS) levels I to III who did and did not receive BoNT-A. The primary outcome was the 66-item Gross Motor Function Measure (GMFM-66), assessed at baseline and annually over 3 years. Secondary outcomes included passive ankle dorsiflexion with knee extended (PADKE) and several measures of activity and participation. **Results:** A total of 117 participants (94%), consisting of 61 cases and 56 comparisons, were assessed on the GMFM-66 at a follow-up of 1 year or longer, with 106 (85%) assessed at year 3. There were no significant differences in mean GMFM-66 scores adjusted for baseline differences between groups over time ($\beta_{\text{group}} = 0.92$, standard error [SE] = 0.81, 95% confidence interval [CI] = -0.66 to 2.50; $p = 0.256$). A difference in PADKE favouring the comparison group was observed ($\beta_{\text{group}} = -4.17$, SE = 1.58, 95% CI = -7.27 to -1.08; $p = 0.009$), approaching the 5° minimally important difference. **Interpretation:** Repeated BoNT-A injections over 3 years were not associated with improvements in gross motor function or passive ankle dorsiflexion range in young children with spastic CP functioning in GMFCS levels I to III compared to a comparison group not receiving BoNT-A. PMID: [41042504](#)

14. Growth hormone treatment in cerebral palsy: long-term impact on growth, outcomes, and complications

Juntaek Hong, Sujin Kim, Junghwan Suh, Dong-Wook Rha

Pediatr Res. 2025 Sep 30. Online ahead of print.

Abstract

This study examined the effects of growth hormone (GH) treatment on growth and metabolic parameters, gross motor function, and musculoskeletal complications in children with cerebral palsy. This retrospective single-center study included children who received GH treatment for over 1 year. Data on growth-related variables, metabolic indicators, and disease-specific factors were collected. Statistical analyses examined associations between GH treatment duration and outcomes, with pre- and post-treatment comparisons. Twenty-two patients were enrolled in this study. GH treatment significantly improved height and weight Z-scores, along with insulin-like growth factor-1 Z-scores, regardless of GH deficiency or ambulatory status. Metabolic changes significantly included an increased bone age-to-chronological age ratio, decreased aspartate aminotransferase levels, and elevated uric acid levels. The gross motor function did not decline, and there was no significant worsening of hip subluxation or scoliosis. GH treatment led to significant improvements in growth and metabolic-related parameters without adverse effects on gross motor function or musculoskeletal complications. These findings suggest that GH treatment may be a safe and effective treatment option for children with cerebral palsy, providing potential benefits without increasing the risk of orthopedic complications. This study is the first to assess the long-term effects of GH treatment in children with CP. GH treatment improved height, weight, and insulin-like growth factor-1 Z-scores. Gross motor function did not decline during treatment, and no significant worsening of hip subluxation or scoliosis detected. There is a lack of longitudinal studies on the long-term effects of growth hormone administration in children with CP. It is anticipated that this study will lay the groundwork for large-scale multicenter prospective research. PMID: [41028509](#)

15.A Tele-Rehabilitation Home Exercise Program for Ambulatory Adults with Cerebral Palsy: A Feasibility Study

Margaret E O'Neil, Mary E Gannotti, Lauren Winterbottom, Jessica Byrnes, Jasmin Russo, Noelle DeMartini, Nicole Shatsky, Elisabeth Bellissimo, Michael Spinner, Heakyung Kim

Phys Occup Ther Pediatr. 2025 Sep 30:1–21. Online ahead of print.

Abstract

Examine adherence, facilitators and barriers, satisfaction and trends in effectiveness of a telerehabilitation home exercise program (TRHEXP) with remote coaching for adults with cerebral palsy (CP). Six ambulatory adults with CP (range: 21–38 years, mean: 27, SD: 6.9; 4 females), participated in an 8-week TRHEXP designed to increase physical activity (PA) to 150 min per week (min/wk). Pre, post, and process measures included functional mobility tests, patient reported measures, semi-structured interviews, and exercise observation. Individualized programs were based on clinical guidelines and personal goals. Weekly coaching sessions reviewed adherence, performance, and progression. Four of six participants completed the 8-week program; two dropped out midway through due to life circumstances. PA frequency was a median of 4 ×/wk and a median of 150 min/wk. TRHEXP was the primary contributor to PA. Participant time and energy were barriers. Completing activity logs and perceived improvement were facilitators. Personal goal performance increased to 75% and satisfaction to 100%. Changes to self-report measures and functional tests were equivocal. Ambulatory adults with CP may benefit from individualized TRHEXP with weekly remote coaching to increase PA. Tailored telerehabilitation PA programs with remote coaches may foster health promotion for adults with CP.

PMID: [41025199](#)

16.Frequency-dependent modulation of evoked potentials during GPi-DBS in pediatric dystonia

Rahil Soroushmojdehi, Jessica S L Vidmark, S Alireza Seyyed Mousavi, Sumiko Abe, Terence D Sanger

Sci Rep. 2025 Sep 29;15(1):33551.

Abstract

Deep brain stimulation (DBS) of the globus pallidus internus (GPi) is an established treatment for dystonia, yet the neurophysiological mechanisms underlying frequency-dependent effects remain poorly understood. In this study, we investigate how different GPi-DBS frequencies modulate evoked potential (EP) characteristics within the basal ganglia-thalamo-cortical network in pediatric dystonia patients. We evaluated how increasing stimulation frequency alters EP morphology, focusing on peak-to-peak amplitude (PPa), peak-to-peak duration (PPd), and time to peak (TP). This analysis was motivated by clinical observations that higher DBS frequencies often produce distinct therapeutic effects, suggesting underlying differences in how neural circuits respond to varying stimulation rates. We analyzed intracranial electrophysiological recordings from 13 pediatric and young adult dystonia patients undergoing staged DBS implantation. EPs were recorded from the GPi and subthalamic nucleus (STN) of basal ganglia, and ventral oralis (VO) nucleus of the thalamus during unilateral GPi stimulation at 55, 85, 185, and 250 Hz. EP detection and characterization were performed using an automated algorithm, and group-level analyses were conducted using linear mixed effects models to assess frequency-dependent changes across regions. Increasing stimulation frequency significantly decreased PPa and increased PPd and TP, with a clear threshold effect: 55 Hz and 85 Hz produced similar responses, while 185 Hz and 250 Hz elicited significantly greater changes. These frequency-dependent effects were most pronounced in GPi recordings, followed by STN and VO, suggesting that local circuit dynamics are more sensitive to frequency modulation. Our findings highlight the distinct neurophysiological effects of DBS frequency on EP characteristics, emphasizing the need for personalized DBS programming. The pronounced frequency-dependent modulation observed in GPi suggests that optimal stimulation parameters should be tailored to the target region rather than applying uniform settings across patients. Future studies should investigate the clinical relevance of these EP dynamics and explore their potential as biomarkers for DBS optimization in dystonia.

PMID: [41023077](#)

17.Sleep, interrupted – when short nights take their toll

Aila Akosua Kattner

Biomed J. 2025 Oct 1;48(5):100915. Online ahead of print.

Abstract

Sleep loss is increasingly recognized as a contributor to neuropathic pain, while diagnostic accuracy in thyroid carcinoma may be improved through refined assessment methods. In pediatric patients with cerebral palsy, transcranial magnetic stimulation (TMS) shows promise as a therapeutic intervention. Chronotherapy of blood pressure demonstrates how aligning antihypertensive treatment with circadian patterns may enhance efficacy. Artificial intelligence-based clinical decision support systems offer potential in the management of acute coronary syndromes, although current limitations and risks require careful consideration. Advances in precision oncology include comprehensive genomic profiling and spatial omics, while large language models highlight both opportunities and challenges in healthcare applications. Finally, age-related hormonal changes in combination with mitochondrial dysfunction are discussed in the context of carcinogenesis, underscoring the complex links between aging, metabolism, and cancer development.

PMID: [41038089](#)

18. Visual disorder and sensory integration in 3- to 6-year-old children with cerebral visual impairment and cerebral palsy

Mustafa Cemali, Sümeyye Belhan Çelik
PM R. 2025 Sep 30. Online ahead of print.

Abstract

Sensory and behavioral difficulties are frequently observed in children with cerebral palsy (CP), and these challenges may intensify when cerebral visual impairment (CVI) co-occurs. However, the extent and nature of these combined effects remain underexplored. The aim of this study is to compare sensory processing skills and behavior of children with CP and CVI, CP without CVI, and typically development (TD) and to examine the relationship between sensory processing skills and behavior in children in these groups. A prospective, cross-sectional study with control group was conducted at a special education and rehabilitation center. A total of 120 children aged 3–6 years, consisting of three groups, were included in the study: 40 children with CP and CVI, 40 children with CP without CVI, and 40 children with TD. The Sensory Profile (SP) was used to assess sensory skills and the Child Behavior Rating Scale (CBRS) was used to assess behavior. There were significant differences in all pairwise comparisons between the three groups and between SP subdomains and CBRS scores ($p < .05$). Children with CP and CVI had the lowest median scores (SP: 7–78.5; CBRS: 26), followed by those with CP without CVI (SP: 9–95; CBRS: 33), whereas TD children had the highest scores (SP: 12–129; CBRS: 49). These findings suggest a trend toward worsening sensory and behavioral outcomes in the presence of CVI in addition to CP and in CP alone. Furthermore, moderate to strong positive correlations were observed between SP and CBRS scores in all groups ($\rho = 0.468–0.872$; $p < .001$), suggesting that behavioral problems increase with decreased sensory processing skills. This study reveals that children with CP have more problems in sensory processing and behavioral functioning compared to their peers with TD and that these problems are exacerbated in the presence of CVI accompanying CP. In addition, the significant relationship observed between the decrease in sensory processing skills and the increase in behavioral problems emphasizes the importance of evaluating these two areas together and adopting a holistic approach in intervention planning.

PMID: [41025614](#)

19. Robotic versus treadmill training: Postural stability in ambulatory CP: RCT study

Muzaynah Aljosh, Maha F Algabbani, Jaber Mohammed Fagehi, Manal Bawazeer, Mohammad A Almohiza, Alaa M Albishi, Adel A Alhusaini
Pediatr Int. 2025 Jan-Dec;67(1):e70214.

Background: Postural stability is a prerequisite for the performance of daily gross motor functions. It is usually impaired in children with cerebral palsy. The aim of this study was to compare the effect of robotic-assisted gait training and body weight supported treadmill training on postural stability in ambulatory children with cerebral palsy.

Methods: A randomized clinical trial involved 40 ambulatory children with cerebral palsy (5–14 years old). They were randomly allocated to one of two locomotor treadmill-training groups: (1) robotic-assisted gait training (RAGT) and (2) body weight supported treadmill training (BWSTT). All participants completed 24 training sessions within 8 weeks. Postural stability was measured by a computer dynamic posturography (NeuroCom EquiTest®) before and after the intervention.

Results: A two-way repeated measures ANOVA revealed that there was a statistically significant interaction between group and time [$F(15, 24) = 3.02$, $p = 0.008$]. The study found that RAGT is more effective than BWSTT on some variables of static and dynamic postural stability. RAGT showed more improvement in weight symmetry at 60° knee flexion, limit of stability, velocity composite (front/back), and directional control composite for both left/right and front/back ($p < 0.05$).

Clinical trials: gov (identifier: [NCT06719271](#)). **Conclusion:** Ambulatory children with CP can improve their postural stability after intensive RAGT.

PMID: [41045011](#)

20. Utilizing Technological Intervention for Behavior Problems in Children with Cerebral Palsy within a Tertiary Care Setting

Thirumalai Jeevarathinam, Ramalingam Vinodhkumar
Indian J Community Med. 2025 Sep-Oct;50(5):869–871. Epub 2025 Apr 17.

Abstract

No abstract available.

PMID: [41017875](#)

21. Adults with cerebral palsy

Hunter Loewen, Janet Tapper, Elizabeth Condcliffe
CMAJ. 2025 Sep 28;197(32):E1034.

Abstract

No abstract available.

PMID: [41022480](#)

22. Modeling cerebral palsy in animals

Katharina A Quinlan, Emily J Reedich, Elvia Mena Avila, Brendan C Moline, Landon T Genry, Megan R Detloff, Benjamin R Katholi, Deborah Gaebler-Spira, Bhooma R Aravamuthan
Dev Med Child Neurol. 2025 Oct 3. Online ahead of print.

Abstract

Advancements in the treatment of cerebral palsy depend on animal research. Yet, most animal models have not been fully evaluated for spasticity and dystonia using clinically relevant measures of altered tone or movement patterns, which form the basis for diagnosing people with the condition. Sensory differences and pain are almost never studied in animal models. Complicating factors include the diversity of animals and injuries used to model the condition, the diversity of outcomes after acquired injury, and translating clinical measures into reliable and repeatable measurements tailored to animals, ideally using common data elements. We summarize preclinical models based on acquired injury to the nervous system in cerebral palsy research over the years and provide a comparison of developmental time courses for common laboratory animals. We encourage researchers to coalesce on consistent, reliable measurements for assessing both sensory and motor systems to ensure that animal models reflect meaningful aspects of the condition.

PMID: [41044864](#)

23. Single Event Multilevel Surgery (SEMLS) for Children With Cerebral Palsy (CP) – Does Adding a Second Surgeon Make a Difference?

Michelle Mo, Patricia Miller, Sachin Pathangey, Brian Snyder, Colyn Watkins, Benjamin Shore
J Pediatr Orthop. 2025 Oct 2. Online ahead of print.

Abstract

Single-event multilevel surgery (SEMLS) has been accepted as the standard of care for the surgical treatment of children with cerebral palsy (CP). However, little has been studied on the effect of dual-attending surgeons in SEMLS. The aim of this study was to compare the effect of single versus dual-attending surgeons on resource utilization and postoperative outcomes in children with CP undergoing SEMLS. A total of 70 patients with CP or CP-like conditions, who were <20 years old, and who underwent SEMLS at a single institution, were identified. Bivariate comparisons were conducted using Student's t tests, Mann-Whitney U tests, and chi-squared tests. Stratified analyses were conducted within patient characteristic subgroups to compare operative outcomes within groups. Multivariable regression analyses were used to assess differences across surgeon cohorts while controlling for potential confounding factors. Patients were stratified into single versus dual surgeon cohorts (n=40 vs. n=30, respectively). No significant differences were noted with respect to age, sex, race, BMI, GMFCS level, or ASA level between groups. A higher proportion of patients with a seizure history (67% vs. 38%; P=0.03) and revision procedures (33% vs. 3%, respectively; P=0.001) were found in the dual surgeon cohort. Bivariate analysis demonstrated that operative times in the dual surgeon cohort were significantly decreased in GMFCS level IV/V patients (269.6 ± 46.7 vs. 356 ± 103.4 min; P=0.002) and patients undergoing hip reconstruction procedures (270.6 ± 53.2 vs. 337.4 ± 85.8 min; P=0.007). A significant decrease in total blood loss (20% in hip reconstruction patients, P=0.036, 25% in GMFCS IV/V patients, P=0.049) and OR costs (16% in GMFCS level IV/V patients, P=0.008) was also observed. Moreover, multivariable analysis found that dual surgeon procedures had a 50-minute average reduction in operative time (P=0.005); no differences were noted in complication rates, unplanned clinic visits, or re-operation rates. A 2-surgeon team for SEMLS can significantly decrease operative time, total blood loss, and OR costs—particularly for hip reconstruction and higher GMFCS level patients.

PMID: [41037672](#)

24.[Diagnosis and treatment dyskinesias in pediatrics]

Alma Huerta Hurtado, Alonso Zea Vera

*Medicina (B Aires). 2025 Sep;85 Suppl 4:64–70.***Abstract**

Dyskinesias encompass a range of hyperkinetic involuntary movements that may occur in isolation or in combination. In this review, we focus on four key movement types: dystonia, chorea, ballism, and athetosis. We begin by defining each of these phenomenologies. Next, we explore the etiologies of dyskinetic disorders in the pediatric population, which span a broad spectrum and include cerebral palsy, genetic syndromes, acquired brain injuries, and autoimmune conditions. We then provide an overview of dyskinetic disorders, highlighting specific diagnostic pearls. A particular focus is given to status dystonicus, the most severe and life-threatening form of dystonia exacerbation. Though it can occur in any patient with dyskinesia, it is most associated with genetic forms. Finally, we discuss both pharmacologic and surgical treatments—including deep brain stimulation—using a phenomenology-based approach to management.

PMID: [41036987](#)**25.Brain structural alterations correlate with motor dysfunction in children with spastic cerebral palsy: a quantitative MRI study**

Qiang Wang, Jiale Zhang, Xiang Ren, Qijia Zhan, Wenbin Jiang

*Eur J Med Res. 2025 Sep 29;30(1):906.***Abstract**

Spastic cerebral palsy (CP) is a common cause of motor disability in children which is caused by non-progressive brain injury. This study aimed to investigate the correlation between quantitative brain MRI parameters and motor dysfunction in children with spastic CP. Ninety-one children with spastic CP and 91 controls were recruited. Brain volumes were measured using high-resolution T1-weighted Magnetic Resonance Imaging (MRI). Gross motor function was assessed using Gross Motor Function Measure-66 score (GMFM-66) and the muscle tone was evaluated by modified Ashworth scale and scored by modified Ashworth scale score. Children with spastic CP showed significantly reduced total brain volume, white matter volume, gray matter volume, and white matter/total brain volume ratio compared to controls. In children with spastic CP, white matter volume and white matter/total brain volume ratio positively correlated with GMFM-66 scores ($r = 0.56$, $p < 0.001$; $r = 0.47$, $p < 0.001$). The muscle tone of specific muscles negatively correlated with brain volumes. White matter volumes are closely related to motor dysfunction in children with spastic CP. Quantitative MRI may serve as objective biomarkers for evaluating the severity and prognosis of spastic CP, providing basis for individualized rehabilitation strategies.

PMID: [41023718](#)**26.A Case of Hereditary Spastic Paraplegia Type 50 With a Novel AP4M1 Variant and a Brief Review of the Literature**

Ana Teresa Guerra, André M Travessa, José Paulo Monteiro

*Clin Case Rep. 2025 Sep 25;13(10):e70954. eCollection 2025 Oct.***Abstract**

We report a case of hereditary spastic paraplegia type 50, an extremely rare disease characterized by upper motor neuron dysfunction. This case underscores the importance of considering genetic etiologies in patients previously diagnosed with cerebral palsy, especially when clinical history, presentation, and imaging findings are inconsistent with typical brain injury patterns.

PMID: [41018996](#)**27.An updated cerebral palsy description: Reflections on semantics, genetics, and the usefulness of a plain language version**

Anina Ritterband-Rosenbaum, Line Zacho Greve, Pernille Ulrik Kaster, Patricia de Liphay Behrend

*Dev Med Child Neurol. 2025 Oct 4. Online ahead of print.***Abstract***No abstract available.*PMID: [41045505](#)

28. Investigation of health-related quality of life and caregiver burden following hip reconstructive surgery in nonambulatory children with cerebral palsy: a prospective observational study

Mehmet Demirel, Taha Bedir Demir, Abdullah Kahraman, Ahmet Muçteba Yildirim, Nur Canbolat, Yavuz Sağlam, Fuat Bilgili

J Pediatr Orthop B. 2025 Sep 29. Online ahead of print.

Abstract

Reconstructive hip surgery is essential for managing hip displacement in nonambulatory children with cerebral palsy (CP); however, its impact on health-related quality of life (HRQoL) and caregiver burden remains unclear. This study evaluates postoperative changes in HRQoL and caregiver burden. This prospective observational study included 19 nonambulatory children with spastic CP classified as Gross Motor Function Classification System (GMFCS) levels III–V undergoing reconstructive hip surgery. HRQoL and caregiver burden were assessed using the Pediatric Quality of Life Inventory (PedsQL 4.0) and the Zarit Burden Interview (ZBI), respectively, at baseline and during a 12-month follow-up. Subgroup analyses were performed based on Reimers' migration index, GMFCS levels, and age. PedsQL scores showed a continuous improvement over 12 months, with a significant increase from baseline to 1 year ($P < 0.001$). Caregiver burden (ZBI) slightly increased at 3 months but progressively declined thereafter, with significant reductions at 9 months ($P = 0.010$) and 12 months ($P = 0.002$). Subgroup analyses by Reimers' migration index, GMFCS level, and age revealed no significant between-group differences in outcome scores ($P > 0.05$). Reconstructive hip surgery enhances HRQoL and reduces caregiver burden over time in nonambulatory children with CP. These findings highlight the long-term benefits of surgical intervention.

PMID: [41017423](#)

29. Occupation-Based Collaborator Engagement in Research: Developing a Cerebral Palsy Task Force

Angela Shierk, Nancy Clegg, Daralyn Fulton, Lindsay Miles, Vanessa Hunt, Mauricio R Delgado, Janet Prvu Bettger, Heather Roberts

OTJR (Thorofare N J). 2025 Sep 27. Online ahead of print.

Abstract

Engaging community collaborators in research is crucial for enhancing health care outcomes, especially for cerebral palsy (CP). However, effective multi-collaborator involvement poses challenges. This study used an occupation-based approach to engage community collaborators in developing a CP Task Force to initiate patient-centered comparative clinical effectiveness research and evaluated member perspectives on roles and experiences. A repeated cross-sectional design was employed, with 18 CP Task Force members completing 39 surveys. Engagement activities focused on social participation, leisure, play, education, and work. Surveys assessed team culture, trust, and role satisfaction. Descriptive statistics analyzed survey data, while thematic analysis summarized qualitative responses. Participants reported high satisfaction and engagement. Key themes included inclusivity, effective communication, accessibility, and expanded engagement. Occupation-based engagement can enhance collaboration, build rapport, and create a shared sense of purpose among multi-collaborators when establishing a CP Task Force to support patient-centered comparative clinical effectiveness research.

Plain language summary

Involving Families and Caregivers in Research to Improve Care for Children with Cerebral Palsy Research that involves families, caregivers, and others with experience in caring for children with cerebral palsy (CP) is essential for improving the research that leads to valuable treatments and outcomes. However, it can be difficult to effectively include these voices in the research process. This study aimed to find a better way to involve the people most affected by CP—children, families, caregivers, and professionals—in research that will help improve care and treatment. The study created a task force with collaborators who provided various perspectives, including those who care for children with CP. The task force focused on everyday activities that are meaningful and essential to people's lives, such as play, school, and work, an approach grounded in occupational therapy, known as an occupation-based approach. The group met regularly to work together to start a group that supports research that considers the unique needs and experiences of children with CP. The study showed that task force participants were very satisfied with their involvement, feeling that their contributions were valued. They also highlighted the importance of inclusivity, good communication, and expanding access to ensure everyone can participate. The results suggest that using an occupation-based approach to engage families and caregivers to create a task force can help make multi-collaborator engagement in research more relevant, ensuring that collaborators feel comfortable and valued as members of the research team. This approach can be an important tool for occupational therapists and health care researchers to facilitate better involvement of all collaborators in clinical research.

PMID: [41015817](#)

30.Reasons for hospital admissions in children with chronic diseases during the COVID-19 pandemic: A retrospective study

Zehra Çapa, Güleendam Karadağ

Int Emerg Nurs. 2025 Sep 26;83:101689. Online ahead of print.

Abstract

This study was conducted to investigate the reasons for hospital admissions in children with chronic diseases during the COVID-19 pandemic. A descriptive and retrospective study design was employed. The study included the records of children (1,018 children) who had been diagnosed with chronic diseases and had presented to the pediatric polyclinics, pandemic polyclinics, and emergency departments of a state hospital between April 1, 2020 and March 31, 2021. For the disease diagnoses of the children, the ICD 10 codes entered into the system for the most common diseases seen in children, like epilepsy, asthma, and cerebral palsy, were searched. Descriptive statistical methods (frequencies and percentages) were used to analyze the data; no statistical significance testing or group comparisons were conducted. The mean age was 8.74 ± 4.63 years. It was found that 32.58% of the children with epilepsy and 19.77% with asthma had presented to the pediatric emergency department with fever and 26.32% of those with cerebral palsy had presented with nausea and vomiting. A total of 212 PCR samples had been taken from children, and PCR test results of 15.57% were positive. The procedures applied to the children during outpatient clinic presentations were 'examination' for girls (38.88%) and boys (37.41%) with epilepsy, 'examination and test requests' for girls with asthma (23.35%), and 'examination and prescription' for boys with asthma (22.35%), and 'examination' for both girls (39.18%) and boys (33.90%) with cerebral palsy. It was found that the majority of children diagnosed with epilepsy had presented to pediatric neurology, those with asthma to pediatric allergy, and those with cerebral palsy to pediatric neurology departments. The most frequently performed procedures in children with epilepsy, asthma, and cerebral palsy were physical examination, test requests, prescription issuance, disability report issuance, and preparation of medication reports.

PMID: [41014776](#)

Prevention and Cure

31.Magnetic resonance imaging and spectroscopy in neonatal encephalopathy: current consensus position and future opportunities

Abbot Laptook, Aisling A Garvey, Caroline Adams, Patricia Ellen Grant, Eleanor J Molloy, Floris Groenendaal, Lauren C Weeke, Manon Benders, Misun Hwang, Mohamed El-Dib, Nadia Badawi, Nicola J Robertson, Raymand Pang, Sudhin Thayyil, Terrie Inder, Ted Carl Kejlberg Andelius, Kasper Jacobsen Kyng

Pediatr Res. 2025 Oct 3. Online ahead of print.

Abstract

Neonatal encephalopathy (NE) is a significant global health concern. It is a leading cause of long-term neurodevelopmental impairment, with hypoxic-ischaemic perinatal brain injury being the most common underlying contributor. Although therapeutic hypothermia has reduced mortality and improved outcomes for some affected infants, many survivors experience neurodevelopmental disability, including cerebral palsy and/or deficits in cognition, behaviour, and executive functioning. Early and accurate prognostication and identification of injury severity remain a challenge due to evolving clinical signs and multiple etiologies. Magnetic resonance imaging (MRI) is the gold standard for characterizing NE-related brain injury. Diffusion-weighted imaging (DWI) enables early detection of injury, and proton magnetic resonance spectroscopy (1H-MRS), specifically the Lac/NAA peak area ratio from basal ganglia and thalamus, provides robust prognostic indicators of two-year neurodevelopmental outcomes. MRI scoring systems incorporating multiple modalities correlate well with later neurodevelopmental outcomes. Advanced imaging modalities, such as diffusion tensor imaging (DTI), arterial spin labelling (ASL), and blood oxygen level-dependent (BOLD) imaging, offer further insights into microstructural integrity, perfusion, and functional connectivity. By standardizing acquisition protocols and post-processing, MRI biomarkers can serve as reliable, early surrogate endpoints in neuroprotection trials, allowing smaller sample sizes and accelerating clinical translation. MRI and 1H-MRS integration enhances prognostication, guides clinical management, and supports informed decision-making in NE care. IMPACT: This article highlights the importance of state-of-the-art MRI and MRS techniques for assessing neonatal encephalopathy (NE), emphasizing optimized protocols, accurate interpretation, and the use of MRI scoring systems to enhance clinical decision-making. It provides a comprehensive guide to advanced MRI/MRS acquisition and interpretation in neonates with NE, addressing current limitations and future directions. By optimizing neonatal MRI/MRS practices, this work aims to improve early diagnosis and prognostication, guide treatment strategies, and ultimately improve the management of neonates with NE.

PMID: [41044228](#)

32. Advancing regenerative therapies with umbilical cord-derived mesenchymal stem cells: A review

Mohamed Hussein

Biomol Biomed. 2025 Oct 1. Online ahead of print.

Abstract

Umbilical cord-derived mesenchymal stem cells (UC-MSCs) are a clinically attractive regenerative and immunomodulatory platform that combines ethical accessibility, low immunogenicity, rapid expansion, genetic stability, and a potent paracrine secretome. This study aimed to synthesize evidence on safety, efficacy, and translational readiness by conducting a focused PubMed review (2014–2024) restricted to clinical studies and trials, using predefined inclusion and exclusion criteria and structured data extraction. Across indications, UC-MSCs show a consistent safety profile and signals of benefit mediated by tissue repair and immune regulation: in musculoskeletal disease they improve osteoarthritis pain and function and may slow osteonecrosis; in hepatology they sustain gains in decompensated cirrhosis, mitigate acute allograft rejection, and aid recovery from ischemic-type biliary lesions; as induction in renal transplantation they are feasible with early graft benefits; in type 2 diabetes responders improve glycemic control and inflammation, while maternal and obstetric factors can shape intrinsic cell properties; in neurology, studies in cerebral palsy, chronic spinal cord injury, and traumatic optic neuropathy report motor, sensory, and visual improvements; in COVID-19-related acute respiratory distress syndrome (ARDS) trials show better oxygenation, radiological recovery, quality of life, and modulation of the TNF-sTNFR2 axis; in immune-mediated and transplant settings they reduce graft-versus-host disease, with signals in systemic lupus erythematosus, refractory immune thrombocytopenia, Crohn's fistulas, and as cotransplant support in aplastic anemia. The limitations of this study encompass small sample sizes, single-center designs, and short-duration trials. Additionally, there is significant heterogeneity concerning the source, manufacturing processes, dosage, administration routes, and endpoints. Other challenges include adherence to good manufacturing practices (GMP), issues related to potency, biobanking, logistical constraints, cost factors, and regulatory obstacles. Large multicenter randomized trials with standardized protocols and long-term follow-up, and combination strategies with biomaterials, gene engineering, and extracellular vesicle or exosome products, are needed to confirm durable benefit and enable routine clinical integration.

PMID: [41036706](#)

33. Sodium Alginate Silk Fibroin Hydrogel Loaded with Neural Stem Cells for Treatment of Cerebral Palsy

Simiao Yu, Chenyu Liu, Zhangrong Lou, Weihong Qiao

Biomacromolecules. 2025 Oct 1. Online ahead of print.

Abstract

The application of stem cell therapy for neural tissue regeneration is often limited by low cell survival after transplantation. To overcome this, we developed an injectable hydrogel via dual cross-linking: Schiff base formation between oxidized alginate and silk fibroin (SF) and host-guest interactions between β -cyclodextrin (β -CD) and adamantane. The resulting hydrogel exhibits high water content, injectability, electrical conductivity, suitable degradation, and excellent biocompatibility. Neural stem cells (NSCs) encapsulated within the hydrogel showed high viability, proliferation, and neuronal differentiation capacity in vitro. In a rat model of cerebral palsy (CP), NSC-laden hydrogel transplanted via intracranial injection promoted significant structural repair and functional recovery, as confirmed by behavioral tests, histology, and proteomics, indicating its potential therapeutic effect on the repair of cerebral tissue in CP. This indicates that the hydrogel has broad application prospects in the field of brain nerve tissue repair.

PMID: [41031790](#)