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Monday 26 May 2025

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Interventions and Management

Interventions and Management

1.The Effectiveness of Modified Constraint Induced Movement Therapy on Upper Limb Function in Children with Hemiplegic Cerebral Palsy. A systematic review and meta-analysis

Ehab Mohamed Abd El-Kafy, Nahla Almatrafi, Mohamed Salaheldien Alayat, Nawal Tawhari, Najwa Abuallam, Hayam Mahmoud

Neuropediatrics . 2025 May 20. doi: 10.1055/a-2616-4893. Online ahead of print.

Abstract
Objective: To assess the effectiveness of Modified Constraint Induced Movement Therapy (mCIMT) in improving upper limb function and grip strength in children with hemiplegic cerebral palsy (CP).
Methods: A comprehensive search was conducted from inception to August 2024. Eligibility criteria were studies evaluating the effectiveness of mCIMT on upper limb function in children with hemiplegic CP aged over 2 years. The following data was extracted from each study: participant characteristics, intervention, outcome measures, follow-up, and key findings. The risk of bias and the quality of the evidence were evaluated using the PEDro scale and the Grading of Recommendations Assessment Development and Evaluation (GRADE), respectively. A meta-analysis using a random-effect model was performed, and standardized mean difference (SMD) with a 95% confidence interval (CI) was estimated for upper limb function and grip strength.
Results: A total of 25 studies)1115 children) were included. PEDro scale revealed twelve good-quality studies, eight fair-quality studies, and five poor-quality studies. The currently available evidence showed a significant large effect of mCIMT in improving upper limb function (SMD 1.14 [95% CI 0.46 to 1.83]; P =0.001; 12 studies; 454 children; very-low-quality evidence) and significant medium effect in improving grip strength (SMD 0.63 [95% CI 0.12 to 1.14]; P=0.02; 3 studies; 92 children; low-quality evidence).
Conclusion: mCIMT could improve upper limb function and grip strength in children with hemiplegic CP. However, due to the low and very low quality of evidence, further high-quality trials are needed to confirm these effects.
PMID: 40393681

2.Impact of Exercise Modalities on Upper Extremity Spasticity in an Adult with Quadriplegic Cerebral Palsy: A Case Report

Juntack Oh, Michele Aquino

Case Reports J Funct Morphol Kinesiol . 2025 May 15;10(2):177. doi: 10.3390/jfmk10020177.

Abstract
Background: Spasticity, a hallmark of quadriplegic cerebral palsy (CP), severely impacts mobility and quality of life. While exercise is known to enhance fitness and motor function in individuals with CP, its specific efficacy in reducing upper extremity spasticity remains insufficiently studied. This research investigated the effects of weight-resistance exercise (RE), hand cycle bike exercise (BE), and aquatic exercise (AE) on upper extremity spasticity in an adult with quadriplegic CP.
Method: The participant was a 35-year-old individual with quadriplegic spastic CP, presenting severe spasticity in the right upper extremity and lower limbs, and milder left arm involvement. Dependent on a power wheelchair, they were cognitively intact, college-educated, and had participated in a community exercise program for five years. Over nine weeks, the participant completed 18 sessions-6 per modality of RE, BE, and AE-with each session held twice weekly for 50 min. Spasticity was assessed using the Modified Ashworth Scale (MAS) before and after sessions, with comprehensive pre- and post-intervention evaluations. Result: Total MAS scores decreased significantly from 2.76 to 2.33 ($p < 0.05$). AE yielded the largest reduction (2.81 to 2.10), followed by BE (2.75 to 2.36) and RE (2.72 to 2.54). ANOVA confirmed AE's superior efficacy ($F(2,15) = 27.20$, $p < 0.001$, $\eta p2 = 0.78$), with a 0.33 reduction overall. Conclusions: AE was most effective, likely due to buoyancy, followed by BE, with RE showing the least impact. These findings highlight aquatic interventions as promising for spasticity management in CP, necessitating further longitudinal, multi-participant research.
PMID: 40407461

3.Responsiveness of the Seated Postural & Reaching Control Test in Children with Cerebral Palsy: A Preliminary Study

Victor Santamaria, Jaya Rachwani, Madeline Irmen, Wajiha Khatri, Jazmin Stepchuk, Geoffroy Saussez, Yannick Bleyenheuft, Andrew M Gordon, Marjorie Woollacott

Phys Occup Ther Pediatr . 2025 May 19:1-16. doi: 10.1080/01942638.2025.2498356. Online ahead of print.

Aims: To examine the responsiveness of the Seated Postural & Reaching Control (SP&R-co) test in children with cerebral palsy (CP) classified at levels III to V on the Gross Motor Function Classification System (GMFCS).
Methods: Eleven children received a motor learning-based intervention. Expert and blinded raters scored pre- and post-intervention SP&R-co test videos. Responsiveness was measured with paired t-tests, and effect sizes with Cohen's d. Minimum Clinically Important Differences (MCIDs) were estimated for SP&R-co overall and dimension scores.
Results: The SP&R-co test was responsive to group improvement in sitting-related postural and reaching control (SP&R-co overall = 48.9 points, $p < 0.001$). It captured increases in the active (change = 2.4 points, $p = 0.040$), proactive: bimanual (change = 10.5 points, $p = 0.001$), proactive: unimanual (change = 19.8 points, $p < 0.001$), and reactive (change = 15.3 points, $p = 0.016$) dimensions. Most children showed overall score improvements exceeding the MCID value, whereas clinical improvements in dimension scores varied across children with different GMFCS levels.
Conclusions: This preliminary study shows that the SP&R-co test is responsive to clinical changes in postural and reaching control strategies in children with CP who can follow test directions and are classified as GMFCS levels III-V.
PMID: 40387098

4.Safety and effectiveness of non-invasive brain stimulation on mobility and balance function in children with cerebral palsy: a systematic review and meta-analysis

Mengru Zhong, Yage Zhang, Jie Luo, Tingting Chen, Jingbo Zhang, Tingting Peng Sr, Mingshan Han, Wen Le, Tingting Peng Jr, Kaishou Xu

Meta-Analysis J Neuroeng Rehabil . 2025 May 18;22(1):111. doi: 10.1186/s12984-025-01619-7.

Background: Children with cerebral palsy (CP) experience significant mobility and balance impairments. Non-invasive brain stimulation (NIBS), including transcranial direct current stimulation (tDCS) and repetitive transcranial magnetic stimulation (rTMS), has emerged as a potential therapeutic intervention. Nevertheless, the safety and effectiveness of NIBS in children with CP remain uncertain and require further investigation. This study aimed to evaluate the safety and effectiveness of NIBS in improving mobility and balance function in children with CP.
Methods: Randomized controlled trials written in English were searched in five databases (PubMed, Embase, Scopus, Web of Science, and ProQuest), from the first available records in each database to April 2024. Statistical analysis focused on outcomes related to mobility and balance function immediately following intervention and one-month follow-up.
Results: A total of 16 studies encompassing 346 children with CP, aged 3-14 years, were included. The meta-analysis indicated that NIBS is safe and well-tolerated [Risk Difference = 0.16, 95% CI - 0.01-0.33], with a low incidence of adverse events. Significant improvements were observed in mobility post-intervention and at one-month follow-up, particularly in Gross Motor Function Measure scores [standard mean difference (SMD) = 0.47 to 0.63, $P < 0.05$]. Gait parameters, including gait velocity (SMD = 1.28, $P < 0.01$) and stride length (SMD = 0.70, $P = 0.01$) showed immediate improvements. However, no significant improvements were found in balance post-tDCS or at follow-up.
Conclusions: Our findings support the use of NIBS as a safe and feasible tool for enhancing mobility in children with CP, demonstrating both immediate and sustained improvements in gait parameters such as velocity and stride length. However, the impact on balance remains inconclusive. Future research should focus on extending follow-up periods, increasing sample sizes, and exploring tailored stimulation protocols to better understand the long-term efficacy and optimal application of NIBS in pediatric populations.
PMID: 40383797

5.Structural brain correlates of balance control in children with cerebral palsy: baseline correlations and effects of training

Nina P T Jacobs, Marjolein M van der Krogt, Annemieke I Buizer, Laura A van de Pol, Chloé E C Bras, Frederik Barkhof, Pieter Meyns, Petra J W Pouwels

Brain Struct Funct . 2025 May 20;230(5):67. doi: 10.1007/s00429-025-02937-1.

Abstract
Structural brain abnormalities likely underlie impaired balance control in cerebral palsy (CP). This study investigated whether balance measures were associated with measures derived from conventional MRI and diffusion tensor imaging (DTI), and whether an X-Box One Kinect balance training (6 weeks, 5 days/week, 30 min/session) could induce neuroplastic changes in CP. Twelve children with spastic CP (age:11.3 ± 2.3y) underwent balance evaluation and MRI examination, at baseline and after training. Nine age-matched typically developing (TD) children underwent baseline measurements. Balance control was evaluated testing advanced motor skills (Challenge score) and during gait (medio-lateral Margin of Stability, MoS). With conventional MRI, but especially with DTBM (DTI-based VBM), we found smaller volumes of several deep grey matter structures and within the right inferior parietal cortex, right supramarginal cortex, and left postcentral cortex, and lower fractional anisotropy (FA) and smaller volumes of various white matter regions in CP compared to TD. Within the CP group alone, no correlations within brain tissue were found. After training, Challenge scores of children with CP improved. In an exploratory analysis DTBM showed a trend for volume increase within the right inferior parietal cortex, volume decrease within the right retrolenticular limb of the internal capsule, and an increase of FA within the right corticospinal tract. This indicates that a 6-week balance intervention may induce neuroplastic changes in children with CP. CP-RehOP (trial registration number: NTR6034/NL5854, date of registration: August 26th 2016).
PMID: 40392317

6.Exploring experiences of parents of young children with cerebral palsy with a standing frame program promoting hip development

Dorine A van Bentum-Schouwink, Jan J W van der Burg, Katya A M Ceelen, Monique M O van Beneden, Judith C van Munster, Brenda E Groen

Disabil Rehabil . 2025 May 20:1-10. doi: 10.1080/09638288.2025.2505215. Online ahead of print.

Purpose: Children with Cerebral Palsy (CP) are at risk for hip problems, and early monitoring and intervention are recommended. This study explores the experiences of parents of young children with CP with a standing frame program (SFP) promoting hip development and identifies factors promoting or hindering the program's feasibility.
Methods: Qualitative data were collected through 11 interviews, which were transcribed, and analyzed thematically. Quantitative data were collected through ratings of the level of agreement with statements related to the SFP.
Results: For parents, balancing between their roles as parent and co-therapist, implementing the SFP involved physical and mental load. Involving the social environment, sharing care responsibilities, and integrating the SFP in different settings facilitated implementation of the program. Parents were motivated by potential benefits for their child and the opportunity for quality time.
Conclusions: Implementing the SFP is challenging for parents. For better integration of the SFP program into daily life, it is important to consider parents' needs and to collaborate with all caregivers. Future research should strengthen evidence on the SFP's impact on hip development and parental burden. Additionally, it is essential to ensure that the perspectives of burdened parents are incorporated in the program's development and evaluation.
Plain language summary
Implementing a Standing Frame Program is challenging for parents of children with cerebral palsy. For optimal implementation of a Standing Frame Program, it is important to consider parents' needs and possibilities, and to collaborate with them and other caregivers. Verbal and written information about the standing frame including suggestions for activities while standing is important not only for parents but also for other family members, relatives, friends and others involved. A more user-friendly design could address the challenges parents face with cleaning, storing, and transporting the standing frame, particularly since it is not collapsible, making it difficult to take it to other locations such as family and friends' homes.
PMID: 40395020

7.Effect of modified scooter board therapy on trunk control and hip muscle activation in children with cerebral palsy - A pilot randomised control study

Shreekanth D Karnad, Amitesh Narayan, Nutan Kamath, Bhamini Krishna Rao, Monika Sharma, Vijaya Kumar K

IBRO Neurosci Rep . 2025 Apr 19:18:705-713. doi: 10.1016/j.ibneur.2025.04.009. eCollection 2025 Jun.

Abstract
Cerebral palsy (CP), with an incidence rate of 2.95, is one of the leading causes of disability in children. The excessive tone in several muscle groups causes significant movement deficits and secondary impairments, such as hip displacement, affecting quality of life. Although age-related functional positioning treatment is effective, it does not prevent secondary deficits. Literature recommends the use of task-based training with an emphasis on the functional elongation of these spastic muscle groups. Thus, a therapy that is engaging, parent-inclusive, and addresses hip-related deficits is needed. Hence, this study aimed to develop and evaluate a therapy targeting adductor overactivity and trunk control. Modified Scooter Board Therapy (MSBT) is an intervention that uses a specially designed scooter board device, allowing children to propel themselves forward while positioned prone with hip abduction and neutral hip rotation. A convenient sample of eight children with CP were assigned to either the MSBT or conventional exercise group. The intervention lasted eight weeks, and electromyographic (EMG) recordings at rest and during volitional activity were obtained at baseline and after eight weeks. Non-parametric statistical analysis, with a significance level of $p < 0.05$, showed no statistically significant differences between the groups at the end of the eight weeks. However, volitional hip adductor activity significantly changed in the MSBT group, indicated by a reduction in mean motor unit potential at rest. Additionally, parents preferred MSBT for its ease of use. Thus, MSBT appears to be a clinically promising intervention to reduce adductor hypertonicity and improve active control, highlighting the importance of prone positioning with active elongation for better motor function.
PMID: 40384852

8.Exploring the rationale for prescribing ankle-foot orthoses and supramalleolar orthoses to children with cerebral palsy among pediatric orthotists in Australia

Asumi H Dailey, Sarah Anderson, Michael P Dillon

Prosthet Orthot Int . 2025 May 22. doi: 10.1097/PXR.0000000000000457. Online ahead of print.

Objectives: To explore the rationale for prescribing ankle-foot orthoses and supramalleolar orthoses in children with cerebral palsy among pediatric orthotists in Australia.
Methods: Purposive, convenience, and snowballing sampling were used to recruit pediatric orthotists across Australia. Semistructured interviews were recorded and transcribed. The data were independently coded to derive themes and subthemes with illustrative first-person quotes.
Results: Participants (n = 16) in the sample were diverse in their age, years of clinical experience, and state of residence reflecting the breadth of pediatric orthotists in Australia. Two themes were generated: rationale for orthotic prescription and alignment of prescription rationale with child/family goals. Experienced clinicians could clearly articulate the key factors that influence their orthotic prescription aligned to the reasons why children/families sought orthotic intervention. Early to mid-career clinicians found this more challenging.
Conclusions: The rationale for the orthotic prescription should be aligned with the child/family's treatment goals. With a clear focus on treatment goals, the rationale for prescribing either ankle-foot orthoses or supramalleolar orthoses could be clearer if clinicians focused on key primary factors (eg, presence of crouch gait) and then optimized the prescription using a range of secondary factors (eg, body mass).
PMID: 40408084

9.Study protocol for Active Start Active Future: a randomised control trial of an early behaviour-change intervention targeting physical activity participation and sedentary behaviour in young children with cerebral palsy living in South East Queensland, Australia

Gaela Kilgour, Sarah Elizabeth Reedman, Sjaan R Gomersall, Leanne Sakzewski, Stewart Trost, Roslyn N Boyd

BMJ Open . 2025 May 19;15(5):e087697. doi: 10.1136/bmjopen-2024-087697.

Introduction: The benefits of physical activity (PA) are compelling for all ages and abilities. For children with cerebral palsy (CP), two distinct health behaviours, being physically active and reducing sedentary time, are critical to target as an early intervention to reduce long-term morbidity. One approach may be to increase PA participation by empowering parents who are key to making family lifestyle changes. This study will compare Active Start Active Future, a participation-focused intervention, to usual care in a mixed-methods randomised waitlist-controlled trial.
Methods and analysis: A total of 40 children with CP (3-7 years), classified in Gross Motor Function Classification System (GMFCS) levels II-V, will be stratified (GMFCS II vs III, IV vs V) and randomised to receive either (1) Active Start Active Future, an 8-week intervention for 1 hour per week in any setting or (2) usual care followed by delayed intervention. Active Start Active Future aims to increase PA and reduce sedentary behaviour of young children with CP by providing participatory opportunities to promote PA behaviour change. Outcomes will be measured at baseline (T1), immediately postintervention at 8 weeks (T2) and at 26 weeks postbaseline (T3). The primary outcomes are the Canadian Occupational Performance Measure for both child and parent participation goals and child physical performance goal. Secondary outcomes include daily time spent in moderate to vigorous PA and sedentary time, gross motor function, quality of life, barriers to participation for the children and parents' PA and sedentary time. Intervention acceptability and experiences of PA participation will be explored using a qualitative descriptive approach.
Ethics and dissemination: The Children's Health Queensland Hospital and Health Service Human Research Ethics Committee (HREC/23/QCHQ/100850) and The University of Queensland Human Research Ethics Committee (2024/HE000054) have approved this study. The results of the study will be disseminated to families and community agencies as guided by our advisory group and as conference abstracts and presentations, peer-reviewed articles in scientific journals and institution newsletters and media releases.
Trial registration number: ACTRN12624000042549, Universal Trial Number: U1111-1300-7421; Australian New Zealand Clinical Trials Registry.
PMID: 40389315

10.The use of DBS in the treatment of childhood cerebral palsy: a systematic review

Marcelo Anchieta Rohde, Rhaná Carolina Santos, Rafaela Jucá Lindner, Cristiano Mendes Ribeiro, Caroline Saldanha Custódio, Fernando Vélez Feijó, Amauri Dalla Corte

Review Childs Nerv Syst . 2025 May 23;41(1):187. doi: 10.1007/s00381-025-06852-y.

Purpose: To evaluate the efficacy and safety of DBS as a therapeutic intervention for managing motor symptoms and improving quality of life in patients with CP.
Methods: A systematic review was conducted following PRISMA guidelines. Studies were selected from PubMed, SCIELO, and the Regional Portal of BVS using defined inclusion criteria, assessing DBS outcomes on motor function, quality of life, and adverse events. The GRADE system evaluated the risk of bias.
Results: Of the 11 studies reviewed, 107 patients aged 5 to 26 years were included. Most studies focused on bilateral GPi stimulation, with nine reporting improvements in motor symptoms. However, outcomes varied, with significant benefits observed primarily in younger patients. Complications occurred in 22.4% of patients, predominantly infections and device-related issues.
Conclusion: This review showed that GPi DBS can improve motor symptoms and reduce disability in patients with CP, although outcomes are variable and influenced by patient characteristics, such as age. Further large-scale longitudinal studies are necessary to optimize candidate selection and enhance long-term outcomes.
PMID: 40407856

11.Validation of the 6-Minute Frame Running Test as a Cardiopulmonary Exercise Test for Adolescents and Young Adults With Cerebral Palsy

Emma Hjalmarsson, Arnoud Edelman Bos, Linnéa Corell, Annika Kruse, Rodrigo Fernandez-Gonzalo, Jessica Norrbom, Eva Pontén, Petra van Schie, Annemieke I Buizer, Ferdinand von Walden

Adapt Phys Activ Q . 2025 May 20:1-16. doi: 10.1123/apaq.2024-0153. Online ahead of print.

Background: Individuals with cerebral palsy (CP) are at risk of poor health due to low aerobic fitness, yet valid assessment methods are limited, especially for individuals with severe CP. This study validated the 6-Minute Frame Running Test (6-MFRT) for assessing aerobic capacity in adolescents and young adults with CP.
Method: Cardiorespiratory responses, blood lactate levels, and subjective exertion during the 6-MFRT were compared with data from the Frame Running Incremental Treadmill Test (FRITT) in 16 participants with CP, age 23 (6.5) years, with Gross Motor Function Classification System Levels II-V.
Results: A strong correlation was found between peak oxygen uptake (VO2peak) in the 6-MFRT and FRITT ($r = .95$, $p < .001$) and between 6-MFRT distance and VO2peak ($r = .71$, $p = .005$). No significant difference in VO2peak was observed between tests ($p = .186$).
Conclusion: The 6-MFRT is a field test for estimating aerobic capacity in frame-running athletes with CP.
PMID: 40398853

12.Using Radial Shock Wave Therapy to Control Cerebral Palsy-Related Dysfunctions: A Randomized Controlled Trial [Response to Letter]

Hisham M Hussein, Ahmed M Gabr, Monira I Aldhahi, Amsha Alhumaidi Alshammari, Hand Zamel Alshammari, Khulood Khleiwi Altamimi, Abdulaziz Mohammed Alqahtani, Ibrahim M Dewir, Shamekh Mohamed El-Shamy, Ahmed Abdelmoniem Ibrahim

Comment Int J Gen Med . 2025 May 13:18:2537-2538. doi: 10.2147/IJGM.S538434. eCollection 2025.

No abstract available
PMID: 40386764

13.Reliance on vision for walking balance is related to somatosensory function in individuals with and without cerebral palsy

Ashwini Sansare, Hendrik Reimann, Barry Bodt, Maelyn Arcodia, Khushboo Verma, John Jeka, Samuel C K Lee

Hum Mov Sci . 2025 May 21:101:103361. doi: 10.1016/j.humov.2025.103361. Online ahead of print.

Aim: To investigate the relationship between somatosensory deficits, specifically ankle and hip joint position sense, two-point discrimination, and vibration on the (1) responses to visual perturbations during walking and (2) response improvements to visual perturbations while receiving a sensory-centric treatment, i.e., stochastic resonance (SR) stimulation, in individuals with and without cerebral palsy (CP).
Methods: Twenty-eight individuals (14 CP, 14 age-and sex-matched controls) walked in a virtual reality cave while receiving visual perturbations. We applied SR to the ankle and hip joints. Data analysis consisted of regression analyses for each sensory test as well as multiple regression analysis (MRA) using all four sensory tests as predictors with the responses to visual perturbation and the improvements in the responses when SR is applied as outcomes.
Results: We found significant and strong correlations between performance on sensory tests and the responses to visual perturbations, and improvements in the responses with SR. Only one predictor could be entered into the MRA, indicating that performance on any of the sensory tests could predict the responses to visual perturbation and the improvements with SR.
Interpretation: Individuals with sensory deficits are more responsive to sensory-centric interventions. This study is an initial step in identifying potential "responders" to sensory therapies in individuals with CP.
PMID: 40403361

14.How Well Do Communication Profiles at 2 Years of Age Predict Outcomes at 9-10 Years of Age in Children With Cerebral Palsy?

Marianne Elmquist, Katherine C Hustad

Lang Speech Hear Serv Sch . 2025 May 19:1-18. doi: 10.1044/2025_LSHSS-24-00089. Online ahead of print.

Purpose: Early identification of diverging developmental trajectories is important to optimize communication interventions for children with cerebral palsy (CP). The aim of this study was to examine if communication profiles at 2 years of age predicted speech, language, and communication outcomes at 9-10 years of age in children with CP.
Method: Twenty-three children with CP (Mage = 9;10 [years;months]) participated in the study comprising of three mutually exclusive 2-year speech-language profiles: not yet talking (n = 10), emerging talkers (n = 9), and established talkers (n = 4). Using generalized linear regression and Kruskal-Wallis rank sum tests, we examined if 2-year speech-language profiles predicted speech, language, and communication outcomes at 9-10 years of age. Outcomes at 9-10 years of age were obtained from classification systems, spontaneous language samples, elicited speech tasks, and parent report.
Results: Based on 2-year speech-language profiles, we found significant differences in speech, language, and communication outcomes at 9-10 years of age. Specifically, children who were not talking at 2 years of age had more restricted outcomes than children who were emerging or established talkers at 2 years of age.
Conclusion: Our study's results provide preliminary evidence that early communication interventions can and should be differentiated based on communication abilities at 2 years of age to maximize later communication outcomes for children with CP.
PMID: 40388831

15.Sitting and caregiver speech input in typically developing infants and infants with cerebral palsy

Kari S Kretch, Emily C Marcinowski, Natalie A Koziol, Regina T Harbourne, Lin-Ya Hsu, Michele A Lobo, Sandra L Willett, Stacey C Dusing

PLoS One . 2025 May 23;20(5):e0324106. doi: 10.1371/journal.pone.0324106. eCollection 2025.

Abstract
The development of independent sitting is associated with language development, but the learning experiences underlying this relationship are not well understood. Additionally, it is unknown how these processes play out in infants with motor impairments and delays in sitting development. We examined the real-time associations between sitting and caregiver speech input in 28 5-7-month-old infants with typical development and 22 7-16-month-old infants with cerebral palsy who were at a similar stage of early sitting development. We hypothesized that object labels would be more likely to co-occur with moments of optimal attention to the labeled object while sitting than while in other positions. Infants were video recorded in five minutes of free play with a caregiver. Coders transcribed caregivers' speech, identified instances of object labeling, and coded infants' and caregivers' attentional states during object labeling episodes. We found that caregivers labeled more objects while infants were sitting than while they were in other positions. However, object labels were not more likely to co-occur with infant attention, infant multimodal attention, or coordinated visual attention to the labeled object during sitting. Infants with cerebral palsy were exposed to fewer labels and were less likely to be attending to objects as they were labeled than infants with typical development. Our findings shed light on a possible pathway connecting sitting and language in typical and atypical development.
PMID: 40408447

16.The nutritional status according to anthropometric indexes and growth patterns in children and adolescents with cerebral palsy: A scoping review of the literature

Andrea A García-Contreras, Lucía Vázquez-Rocha, Carlos García-Contreras

Review Nutr Health . 2025 May 19:2601060251337779. doi: 10.1177/02601060251337779. Online ahead of print.

Background: Determining the nutritional status of children with cerebral palsy (CP) presents numerous challenges. Accurate nutritional assessment is crucial in this population to ensure the provision of appropriate and effective nutritional interventions.
Aim: This scoping review aimed to analyze the most frequently used anthropometric indexes and growth patterns to determine the nutritional status of children and adolescents with CP.
Methods: The literature search was performed in six databases Scopus, Cochrane Library, Web of Science, SciELO, Medline and PubMed. It was conducted on studies that included children aged 0 to 18 years. Sixty-three publications met the inclusion criteria.
Results: The prevalence of undernutrition was higher when WHO growth standards and CDC growth charts were used (93.3% and 56.8%, respectively), whereas the prevalence of normal nutritional status was higher when US CP growth charts were used (92.5%). The prevalence of stunting was higher with the WHO growth standards (97.7%) and lowest with the US CP growth charts (4.3%). The WHO growth standards were the most frequently used (50.8%), followed by the CDC growth charts (22.2%) and the US CP growth charts (12.7%).
Conclusion: The index with more relevance in this scoping review was BMI since it was addressed in 77.8% of the studies. When assessing the nutritional status with typically developed children's patterns, there was a higher prevalence of undernutrition and stunting. When using US CP growth charts, more children were included in the normal range. More studies are needed to determine which growth pattern is a better indicator of health.
PMID: 40388963

17.Development and Validation of a Prognostic Model for Independent Walking in Children with Cerebral Palsy Based on Machine Learning

Wang Yiwen, Yang Yonghui

Arch Phys Med Rehabil . 2025 May 17:S0003-9993(25)00707-5. doi: 10.1016/j.apmr.2025.05.006. Online ahead of print.

Objective: To develop and validate machine learning-based models for predicting independent walking ability in children with cerebral palsy (CP) DESIGN: Retrospective cohort study.
Setting: Data were collected from a national cerebral palsy registry platform and follow-up assessments were conducted telephone interviews.
Participants: Children with cerebral palsy (n=807) registered between January 2016 and December 2020, with follow-up data collected from October 2022 to March 2023.
Interventions: Not applicable.
Main outcome: Measures The primary outcome was independent walking before the age of 6 years old.
Results: Among the 807 participants, 561 (69.5%) achieved independent walking. Univariate Cox regression identified several predictive factors, including neonatal asphyxia, bilirubin encephalopathy, Gross Motor Function Classification System (GMFCS) level before age 2, age of independent sitting, type of CP, MRI classification, GMFM-88 scores, epilepsy, intellectual disability, early preterm birth, and very low birth weight (P<0.05). Machine learning models demonstrated excellent predictive performance, with logistic regression achieving the highest area under the curve (AUC=0.947), followed by XGBoost (AUC=0.946) and multilayer perceptron (AUC=0.945). Cox proportional hazard models identified key predictors for the timing of independent walking, with a nomogram constructed for clinical application. Internal validation confirmed model reliability, though calibration curves indicated potential overestimation for ages 5~6 years.
Conclusion: Machine learning models accurately predict independent walking ability in children with CP, though calibration analyzes indicated potential overestimation for children aged 5~6 years. The proposed nomogram provides clinicians with an interpretable tool for personalized prognosis. While internal validation demonstrated excellent performance, future external validation in multi-center cohorts will be critical to confirm generalizability.
Clinical trial registration number: Not applicable.
PMID: 40389194

18.Navigating mobility equity: Insights and challenges in device utilization for children with cerebral palsy

Charmhun Jo

Dev Med Child Neurol . 2025 May 21. doi: 10.1111/dmcn.16367. Online ahead of print.

No abstract available
PMID: 40396466

19.Technology for healthcare professionals' education about the early detection of cerebral palsy

Adriana Neves Dos Santos, Melissa Gladstone, Alessandra Lemos de Carvalho, Liliane Dos Santos Machado, Egmar Longo

Editorial Braz J Phys Ther . 2025 May 22;29(4):101214. doi: 10.1016/j.bjpt.2025.101214. Online ahead of print.

No abstract available
PMID: 40409008

20.Serious Gaming for Upper Limbs Rehabilitation-Game Controllers Features: A Scoping Review

Andrés Cela, Edwin Oña, Alberto Jardón

Games Health J . 2025 May 21. doi: 10.1089/g4h.2024.0122. Online ahead of print.

Abstract
The use of exergames in the rehabilitation of patients with upper limb dysfunctions has increased significantly. This scoping review aimed to investigate the game controllers (GCs) employed in exergame systems used for rehabilitation, offering insights into the platforms, sensors, and techniques used in their development, implementation, and utilization. We conducted a comprehensive search of Scopus and PubMed databases, encompassing articles published between February 2013 and February 2023. The eligibility criteria included studies on upper limbs (UL) rehabilitation using exergames published in English-language journals, resulting in the identification of 175 pertinent articles. Seven key categories were identified: pathology, participants' conditions, dosage of sessions, GCs, sensors, specific part of the UL rehabilitated, and ergonomics. Stroke (55.4%) and cerebral palsy (6.3%) were the most frequently addressed medical conditions in the exergame-based rehabilitation. The number of participants in the reviewed articles was from one to several hundred. Three types of participants were identified: patients, specialists, and volunteers. Randomized controlled trial (RCT) studies consistently featured a controlled number of sessions (ranging from 6 to 40) lasting an average of 20 minutes, while non-RCT studies displayed more variability. Commercial platforms were favored, accounting for 74.3% of GCs, with physical controllers (57.1%) surpassing virtual ones. Cameras were the predominant sensors (50.3%), although a wide array of sensor types including IMUs, push buttons, and force sensors were also used. Rehabilitation focuses 68% on general UL, 20.6% on hands, 4% on elbows, and 3.4% on arms and shoulders. Notably, only 26.3% of the studies considered ergonomics in the rehabilitation system. Although exergame systems are advancing rehabilitation treatments, there remains a need for further development and research on various aspects, such as ergonomics, controller design, and sensor integration, to enhance their suitability for patient use.
PMID: 40398964

21.Stabilizing brain-computer interfaces through alignment of latent dynamics

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Nat Commun . 2025 May 19;16(1):4662. doi: 10.1038/s41467-025-59652-y.

Abstract
Intracortical brain-computer interfaces (iBCIs) restore motor function to people with paralysis by translating brain activity into control signals for external devices. In current iBCIs, instabilities at the neural interface result in a degradation of decoding performance, which necessitates frequent supervised recalibration using new labeled data. One potential solution is to use the latent manifold structure that underlies neural population activity to facilitate a stable mapping between brain activity and behavior. Recent efforts using unsupervised approaches have improved iBCI stability using this principle; however, existing methods treat each time step as an independent sample and do not account for latent dynamics. Dynamics have been used to enable high-performance prediction of movement intention, and may also help improve stabilization. Here, we present a platform for Nonlinear Manifold Alignment with Dynamics (NoMAD), which stabilizes decoding using recurrent neural network models of dynamics. NoMAD uses unsupervised distribution alignment to update the mapping of nonstationary neural data to a consistent set of neural dynamics, thereby providing stable input to the decoder. In applications to data from monkey motor cortex collected during motor tasks, NoMAD enables accurate behavioral decoding with unparalleled stability over weeks- to months-long timescales without any supervised recalibration.
PMID: 40389429

22.Visual acuity outcomes up to 12 years and risk factors for visual impairment in a national cohort of extremely preterm born children - The Extremely Preterm Infants in Sweden Study (EXPRESS)

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Acta Ophthalmol . 2025 May 20. doi: 10.1111/aos.17525. Online ahead of print.

Purpose: The Extremely Preterm Infants in Sweden Study (EXPRESS) followed a national cohort of extremely preterm born (EPT, i.e. <27 weeks) children until 12 years of age. This study aimed to investigate the longitudinal development of visual acuity (VA) in children born EPT, explore the predictive value of early visual assessments, and evaluate risk factors for visual impairment at the age of 12 years.
Methods: All 462 children born EPT in Sweden during April 2004-March 2007, and surviving to age 6.5 years, and full-term born matched controls were invited to participate in the 12-year follow-up. VA was assessed at 12 years and the results were compared with values at 2.5 and 6.5 years.
Results: At age 12, 332 (72%) EPT survivors and 189 controls were examined. The mean VA in the EPT group was lower than in the control group (1.15, 95%CI [1.12-1.19] vs. 1.33, 95% CI [1.29-1.37]). Fifteen (4.5%) EPT had visual impairment. The examination at age 2.5 failed to identify most of them, while the examination at 6.5 could predict the final visual outcome at 12. Risk factors for visual impairment were low gestational age, moderate and severe intraventricular haemorrhage, treatment-requiring retinopathy of prematurity, cerebral palsy, and cognitive disability.
Conclusion: In this national cohort, the VA outcome at age 12 was lower in children born EPT than full-term controls. As eye examination at 2.5 years did not reliably identify visual impairment, clinical risk factors should be considered in the screening of children born EPT to early identify the visually impaired.
PMID: 40391491

23.Correction for 'Caregiver perspectives on the longlasting impact of the COVID-19 pandemic on children with cerebral palsy in Johannesburg, South Africa'

No authors listed

Published Erratum BMJ Paediatr Open . 2025 May 18;9(1):e002617corr1. doi: 10.1136/bmjpo-2024-002617corr1.

No abstract available
PMID: 40389274

24.Telemedicine for Children With Cerebral Palsy Before, During, and After the COVID-19 Pandemic: An Australian Cohort Study

Simon P Paget, Sarah McIntyre, Amy von Huben, Kirsty Stewart, Tracey Williams, Emma Maly, Katrina Ford, Sue Woolfenden, Natasha Nassar

J Child Neurol . 2025 May 21:8830738251339960. doi: 10.1177/08830738251339960. Online ahead of print.

Abstract
To examine telemedicine use in children with cerebral palsy before, during and since the COVID-19 pandemic. Methods: A retrospective cohort study of 1162 children with cerebral palsy (40.3% female, birth years 2005-2017), attending specialist outpatient clinics at 2 pediatric hospitals in New South Wales, Australia. We categorized outpatient visits from January 2018 to May 2023 as in-person or telemedicine and compared usage pre-, during, and post-COVID-19 periods. Neighborhood socioeconomic disadvantage and geographical remoteness were defined by residential postcode. Results: Of 48 896 outpatient encounters, 11 929 (24.4%) used telemedicine. Telemedicine rates increased during COVID-19 (20.2 per 100 persons/month) and declined post-COVID-19 (15.2 per 100 persons/month, P < .001). Neighborhood socioeconomic disadvantage was associated with higher median outpatient and telemedicine encounter rates. Regional/remote children had lower median outpatient and telemedicine rates. Conclusion: Telemedicine use declined since lifting of COVID-19 pandemic restrictions. Further support will be required to sustain rates and learn from pandemic experiences.
PMID: 40398494

25.Clinical and Neurodevelopmental Characteristics of Paralogous Gain-of-Function Variants at GRIA2 p.Gly792 and GRIA3 p.Gly803

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Clin Genet . 2025 May 20. doi: 10.1111/cge.14770. Online ahead of print.

Abstract
GRIA-related disorders arise from disease-causing variants in GRIA1, GRIA2, GRIA3, or GRIA4 that encode α-amino-3-hydroxy-5-methyl-4-isoxazole propionic acid (AMPA)-type glutamate receptors (AMPARs). Rare monoallelic GRIA1-4 variants affecting AMPAR function can potentially lead to neurodevelopmental disorders. The impact on AMPAR function may manifest as either gain-of-function (GOF) or loss-of-function (LOF). We recruited nine unrelated patients with either known disease-causing GOF variants in GRIA3 at position p.Gly803 or variants at the paralogous position in GRIA2 (p.Gly792). Specifically, five patients carried a de novo GRIA3 variant (p.Gly803Glu or p.Gly803Val), one carried a maternally inherited GRIA3 variant (p.Gly803Ala) and three carried de novo GRIA2 variants (p.Gly792Arg, p.Gly792Val, or p.Gly792Glu) which we demonstrate are also GOF. Recurrent symptoms included developmental delay affecting both motor skills and language abilities; cognitive impairment; behavioral and psychiatric comorbidities; hypertonia, cerebral palsy, non-epileptic myoclonus, and treatment-resistant epilepsy. We also provide insights into social skills, levels of autonomy, living arrangements, and educational attainment. We compared the clinical features associated with the two paralogous GOF GRIA2 and GRIA3 variants. Our study elucidates the developmental aspects, cognitive abilities, seizure profiles, and behavioral challenges associated with these variants and contributes to advancing our understanding and treatment of patients affected by this rare condition.
PMID: 40391499

26.The impact of perinatal brain injury on siblings: a scoping review

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Review Disabil Rehabil . 2025 May 18:1-19. Doi: 10.1080/09638288.2025.2502589. Online ahead of print.

Purpose: (a) To analyze the extent and nature of research available on the impact of childhood perinatal brain injury (PBI) on siblings, (b) to synthetize results in a descriptive manner.
Method: A literature search of 4 databases was performed up to October 2023. Studies addressing issues around siblings of children with PBI, cerebral palsy (CP) or Profound Intellectual and Multiple Disabilities (PIMD) were included. The protocol was drafted using Arksey and O'Malley's framework and the review followed PRISMA reporting guideline.
Results: 35 articles were identified and analyzed, all focused on CP/PIMD. They highlight the impact of CP/PIMD on family functioning, siblings' roles, and relationships. We grouped results in three categories: (1) impact of CP/PIMD on family functioning, (2) impact on the relationships with the person with CP/PIMD and (3) experience of CP/PIMD. Siblings' relationship with the person with CP/PIMD is particularly impacted. Siblings' trajectory and quality of life are modified. CP/PIMD cause psychological, behavioral and cognitive difficulties. Siblings report various support and ways of coping.
Conclusion: Few and heterogeneous studies are available. CP/PIMD significantly impacts siblings' life trajectory. Further studies appear necessary to precisely analyze the issues, study coping strategies, and develop, propose and implement appropriate support for siblings.
Plain language summary
Perinatal brain damage is a major public health problem, with serious and lasting consequences for the person affected and those around him or her Although the sibling relationship is one of the most important in the lives of siblings, the impact of perinatal brain injuries on siblings has been little studied to date Existing studies on the subject show that perinatal brain injuries have an important influence on the experience of siblings It seems that there is a need to develop appropriate support for these siblings
PMID: 40382686

Prevention and Cure

27.Innovative Hydrogel-Based Treatments for Neonatal Stroke

Victor Mondal, Emily Ross-Munro, Kate Firipis, Gayathri K Balasuriya, Ritu Kumari, Md Munnaf Hossen, David R Nisbet, Glenn F King, Richard J Williams, David W Walker, Mary Tolcos, Bobbi Fleiss

Review Stroke . 2025 May 22. doi: 10.1161/STROKEAHA.124.050139. Online ahead of print.

Abstract

Neonatal stroke, occurring within the first 28 days after birth, affects >1 in every 2500 newborns. The weekly adjusted risk of stroke in a term newborn is 3-fold greater than for a male smoker aged 50 to 59 years with diabetes and hypertension. Neonatal stroke has profound clinical and socioeconomic implications, causing cerebral palsy, epilepsy, and various motor, sensory, and cognitive disabilities. Currently, there is no treatment for the brain damage that neonatal stroke causes. Hydrogels, with their tunable elasticity and stiffness, shear-thinning properties, and ability to deliver therapeutic agents locally in a controlled manner, offer significant potential for tissue repair and regeneration. In this review, we synthesize the current knowledge on biocompatible hydrogels, providing insights into how they can be engineered to address the pathophysiology of neonatal stroke and their previous use in repairing severe focal lesions in the adult central nervous system. By exploring cutting-edge hydrogel therapies, this review aims to provide a comprehensive perspective on the potential of hydrogel therapy to improve outcomes for infants suffering from severe brain injury due to neonatal stroke.

PMID: 40401396