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Interventions and Management

Interventions and Management

1.Transcranial direct current stimulation combined with an intensive training program for upper limb rehabilitation in children with unilateral cerebral palsy. A randomized controlled pilot study

Javier Merino-Andrés, Rocío Palomo-Carrión, Julio Gómez-Soriano, Juan José Fernández-Pérez, Diego Serrano-Muñoz, Elena Muñoz-Marrón, Purificación López-Muñoz

Res Dev Disabil . 2025 Apr 3:161:105001. doi: 10.1016/j.ridd.2025.105001. Online ahead of print.

Background: Unilateral cerebral palsy (UCP) presents a greater functional alteration of the upper limb. Among the recommended interventions are certain therapeutic tools, such as transcranial direct current stimulation (tDCS) that could increase the therapeutic window and enhance the effect of interventions.
Aims: To determine the effectiveness of a 3-weeks intervention of cathodal tDCS applied over the motor cortex of the less affected hemisphere combined with a manual function intensive training program in the upper limbs on quality of movement and the spontaneous use of upper limb in children with UCP. Secondarily, quality of life and user´s experience was also assessed.
Methods and procedures: A pilot randomized triple-blind clinical trial was conducted. 18 children with UCP between 4 and 8 years were recruited and randomly allocated to one of the two experimental groups: 1) Active group: cathodal tDCS + intensive motor training; 2) Control group: Sham tDCS + intensive motor training. Assessments were performed before and after the intervention, and at three months follow-up.
Outcomes and results: Outcome measures: Shriners Hospital Upper Extremity Evaluation children's manual experience questionnaire, Paediatric Quality of Life Questionnaire and the Children's Manual Experience Questionnaire (miniCHEQ). Both groups improved in all variables but in the inter-group analysis only quality of life obtained significant results (p = 0.043).
Conclusions and implications: Adding cathodal tDCS to a program of intensive manual function therapy training did not produce a greater improvement on the spontaneous use, nor improving the experience of use in children with UCP. However, this technique has a short-term beneficial effect on quality of life.
PMID: 40184960

2.The screening Hand Assessment for Infants: Feasibility, validity, and reliability based on parents' recordings

Johanna Kembe, Linda Holmström, Eva Broström, Heléne Sundelin, Ann-Christin Eliasson

Dev Med Child Neurol. 2025 Apr 4. doi: 10.1111/dmcn.16318. Online ahead of print.

Aim: To evaluate the concurrent validity and interrater reliability of remote screening Hand Assessment for Infants (s-HAI) in infants aged 3.5 to 12 months at risk of unilateral cerebral palsy (CP), and to assess the feasibility of parents administering and recording the s-HAI play session using a smartphone app.
Method: In this observational study, 30 infants (10 females) at risk of unilateral CP were assessed with remote s-HAI, administered by their parents, and compared with the HAI conducted in a clinical setting. The quality of the s-HAI recordings was assessed and parents' experiences were collected using a questionnaire. The Spearman's rank correlation coefficient (rs) was calculated for the Each Hand Sum score of s-HAI and the corresponding six-item HAI. The interrater reliability of the s-HAI recordings was calculated using the intraclass correlation coefficient2,1.
Results: Parents recorded the s-HAI play session with good quality and found it feasible. A strong correlation of rs = 0.86 ($p < 0.001$) was found between the s-HAI and the six-item HAI. Interrater reliability was 0.96 (95% confidence interval [CI] = 0.92-0.99) for the affected hand, 0.95 (95% CI = 0.90-0.98) for the non-affected hand, and moderate to excellent for individual items.
Interpretation: The s-HAI measures the same construct as the six-item HAI, demonstrating reliable scoring between raters when administered remotely by parents, making the s-HAI a viable tool for the early identification of infants at risk of unilateral CP.
PMID: 40183769

3.Hand Functions Following Prone-weight Bearing on Upper Limb with Active Elbow Extension versus Modified Constraint Induced Movement Therapy in Children with Unilateral Cerebral Palsy - A Randomised Clinical Trial

Amitesh Narayan, Ruth Bavighar, Shyam Krishnan, Abdulaziz Alammari, Shrikanth D Karnad, Deepalaxmi Paresh Poojari

NeuroRehabilitation . 2025 Apr 4:10538135251329200. doi: 10.1177/10538135251329200. Online ahead of print.

Abstract
BackgroundThe atypical upper limb (UL) flexion pattern in children with unilateral cerebral palsy (UCP) debilitates their ability to experience natural weight bearing through arms and hands, leading to restricted mobility and reduced hand functions. The recommended therapeutic strategies to improve hand functions are not standardized, i.e., (varied protocols, treatment schedules, and frequency), though the benefits of UL weight-bearing on hand-opening and prehension skills are well-documented.ObjectiveTo study the efficacy of Static weight bearing (SWB) in Prone on UL with active elbow extension versus modified-constrained induced movement therapy (m-CIMT) on hand functions in children with UCP.MethodsRandomized clinical trial. Subjects (N = 38) were randomized equally (group- 1, SWB, n = 19; and group- 2, m-CIMT, n = 19). Outcome measure- Fine Motor of PDMS-2 (FM_PDMS-2) pre-and post-interventions after 2 weeks.ResultsThe percentage change (post-intervention) for the Grasping and VMI subtests in the SWB group were 37.67% and 14.11%, while for the m-CIMT group were 12.78% and 4.88%, respectively. These changes were highly significant (p 0.000).ConclusionBoth groups, i.e., SWB and m-CIMT, showed significant differences in the percentage change post-intervention. However, the SWB group demonstrated augmented changes over the m-CIMT on both subtests of FM_PDMS-2, hence greater improvement in hand functions following SWB exercises.
PMID: 40183408

4.Wearable sensors for measuring spontaneous upper limb use in children with unilateral cerebral palsy and typical development

Elena Beani, Mattia Franchi de 'Cavalieri, Silvia Filogna, Veronica Barzacchi, Matteo Cianchetti, Martina Maselli, Giada Martini, Valentina Menici, Giuseppe Prencipe, Elisa Sicola, Giovanni Cioni, Giuseppina Sgandurra

J Neuroeng Rehabil . 2025 Apr 3;22(1):71. doi: 10.1186/s12984-025-01601-3.

Background: Unilateral Cerebral Palsy (UCP) is a clinical condition which mainly involves the movement and muscle tone of one side of the body, often impacting the general manual function. While there are some clinical assessment tools aimed to quantify the Upper Limbs (UpLs) use and the manual abilities, acquiring information regarding the motor abilities outside the clinical environment, such as the UpLs use and their asymmetry during daily life, could provide a more complete evaluation of the child and open a new clinical reasoning. For this purpose, wearable sensors are one of the newest approaches for continuously monitoring UpLs functions without being invasive. The aim of this study was to use wearable sensors to compare spontaneous/daily UpLs usage and asymmetry with the Assisting Hand Assessment (AHA) test, as well as comparing the daily UpLs usage behavior of children with UCP with respect to Typical Developing (TD) peers.
Methods: Eighty children (54 with UCP and 26 TD) wore an Actigraph sensor on each wrist during the AHA test and then at least for the following week of daily life. The amount of use of each hand and the asymmetry were analyzed during both the AHA and the following week of daily life using linear regression analysis and ANOVA models.
Results: Significant relationships were found between the asymmetry detected during the week and both the AHA scores and the asymmetry detected during the test. UCP and TD children week asymmetry distributions were significantly different; moreover, some differences were found when grouping them by MACS levels.
Conclusion: This paper proposes a new and easy technological methodology for monitoring UpLs behavior in daily life. Through wearable sensor data analysis, we demonstrate a linear correlation between asymmetry measured during smi-structured assessments and daily life. Additionally, we provide evidence of distinct patterns of UpLs usage between typically developing children and children with UCP in daily life.
Trial registration: Clinical Trials.gov (NCT03054441).
PMID: 40181251

5.Evaluating the Intensity of Muscle Contraction by Near-Infrared Spectroscopy, a Potential Application for Scaling Muscle Spasm

Mehdi Nourizadeh, Yekta Saremi, Amir Parham Pirhadi Rad, Sepideh Mortezanezhad, Iman Amani Tehrani, Jocelyn Bégin, Maria Juricic, Kishore Mulpuri, Babak Shadgan

J Biophotonics. 2025 Apr 3:e70020. doi: 10.1002/jbio.70020. Online ahead of print.

Abstract
Muscle spasticity, common in conditions such as cerebral palsy, spinal cord injury, and multiple sclerosis, is traditionally assessed using the Modified Ashworth Scale, which lacks consistency. This study evaluates near-infrared spectroscopy (NIRS) as a non-invasive tool for measuring muscle contraction intensity. Thirty-seven healthy adults performed isometric contractions at varying intensities (15%, 30%, 45%, and 60% of maximal voluntary contraction), with NIRS sensors monitoring changes in the Tissue Oxygenation Index (TOI) and electromyography (EMG) measuring muscle activity. Results demonstrated a significant negative correlation between contraction intensity and ΔTOI, indicating that higher contraction levels resulted in greater reductions in muscle oxygenation. Additionally, a multinomial logistic regression model confirmed that TOI could reliably predict contraction intensity ($p < 0.001$). This technique could provide real-time, objective data for spasticity assessment, potentially improving treatment plans.
PMID: 40178030

6.Outcome and Femoral Head Deformity Following Hip Guided Growth in Children With Cerebral Palsy at Skeletal Maturity

Kevin Chun-Kai Chiu, Chia-Che Lee, Kuan-Wen Wu, Kuang-Yu Cheng, Ken N Kuo, Ting-Ming Wang

J Pediatr Orthop . 2025 Apr 3. doi: 10.1097/BPO.0000000000002964. Online ahead of print.

Background: Guided growth of the proximal femur, a minimally invasive procedure for coxa valga, shows promising short-term outcomes in cerebral palsy (CP). However, as it alters physis growth, existing studies lack comprehensive long-term analysis until skeletal maturity.
Methods: This retrospective study included children with spastic CP who underwent proximal femur-guided growth surgery between 2012 and 2017, followed until physeal closure. Radiographic measurements included head-shaft angle (HSA), Hilgenreiner-epiphyseal angle (HEA), acetabular index (AI), Reimer's migration percentage (MP), and α angle. Outcomes were compared between ambulatory/nonambulatory (GMFCS I-III/IV, V) and with/without soft tissue release. Factors associated with earlier physeal closure and femoral head deformity were analyzed.
Results: Among 29 patients (53 hips) with guided growth studied at skeletal maturity, 4 patients (6 hips, 11.3%) experienced procedure failure and required varus osteotomy due to severe deformities. It was more common in GMFCS IV-V patients (27.3%, 3/11) than in GMFCS I-III (5.6%, 1/18). In the remaining 25 patients (47 hips), 7 hips (14.9%) received concomitant pelvic osteotomy with AI and MP evaluated separately. All radiographic parameters improved significantly (P<0.001). Epiphysis grew off the screw in 25 hips (53.2%), requiring reinsertion in 19 (40.4%), with a higher rate in nonambulatory children (73.3% vs. 25%, P=0.002). Changes of the parameters showed no difference between ambulatory/nonambulatory (GMFCS I-III/IV, V) and with/without soft tissue release. The cumulative duration of screw crossing the physis was a key factor for earlier closure (P<0.001) and correlated with increased α angle (P=0.039).
Conclusion: Guided growth successfully improved outcomes in both ambulatory and nonambulatory groups, although less effective in severe dysplasia. This minimally invasive procedure has some concerns, including the epiphysis growing off the screw, reinsertion need, earlier physeal closure, and femoral head deformity.
PMID: 40178803

7.Childhood muscle growth: Reference curves for lower leg muscle volumes and their clinical application in cerebral palsy

Bart Bolsterlee, Brian V Y Chow, Jonathan Yu, Suzanne Davies, Catherine Morgan, Caroline D Rae, David I Warton, Iona Novak, Ann Lancaster, Gordana C Popovic, Rodrigo R N Rizzo, Claudia Y Rizzo, Iain K Ball, Robert D Herbert

Proc Natl Acad Sci U S A . 2025 Apr 8;122(14):e2416660122. doi: 10.1073/pnas.2416660122. Epub 2025 Mar 31.

Abstract
Skeletal muscles grow substantially during childhood. However, quantitative information about the size of typically developing children's muscles is sparse. Here, the objective was to construct muscle-specific reference curves for lower leg muscle volumes in children aged 5 to 15 y. Volumes of 10 lower leg muscles were measured from magnetic resonance images of 208 typically developing children and 78 ambulant children with cerebral palsy. Deep learning was used to automatically segment the images. Reference curves for typical childhood muscle volumes were constructed with quantile regression. The median total leg muscle volume of a 15-y-old child is nearly five times that of a 5-y-old child. Between the ages of 5 and 15, boys typically have larger muscles than girls, both in absolute terms (medians are greater by 5 to 20%) and per unit of body weight (1 to 13%). Muscle volumes vary widely between children of a particular age: the range of volumes for the central 80% of the distribution (i.e., between the 10th and 90th centiles) is more than 40% of the median volume. Reference curves for individual muscle volumes have a similar shape to reference curves for total lower leg muscle volume. Confidence bands about the centile curves were wide, especially at the youngest and oldest ages. Nonetheless, the reference curves can be used with confidence to identify small-for-age muscles (centile < 10). We show that 56% of children with cerebral palsy in our cohort had total lower leg muscle volumes that were small-for-age and that 80% had at least one lower leg muscle that was small-for-age.
PMID: 40163724

8."Impact of Age on Gait Deviations and Function After Single Event Multilevel Surgery in Children With Cerebral Palsy"

Alison M Hanson, Jason T Nadeau, Eva M Ciccodicola, Susan A Rethlefsen, Tishya A L Wren, Robert M Kay

J Pediatr Orthop . 2025 Apr 4. doi: 10.1097/BPO.0000000000002973. Online ahead of print.

Background: Single event multi-level surgery (SEMLS) is the standard of orthopaedic care for children with cerebral palsy (CP). The optimal age to perform SEMLS is unclear, with studies showing positive results from childhood to adulthood. Few studies have combined clinical gait analysis with participation and activity outcome measures. The purpose of this study was to examine the effect of age on changes in gait parameters, activity, and participation in children with CP who underwent SEMLS with a follow-up time of 8 to 48 months.
Methods: One hundred twenty-eight participants met the inclusion criteria. Ninety-one participants (71%) were aged under 11 years and 37 participants (29%) were 11 years or older. Changes in gait deviation index (GDI), walking velocity, stride length, functional mobility scale (FMS), and pediatric outcomes data collection instrument (PODCI) scores were calculated. The impact of age on outcomes was analyzed in age groups (<11 vs. ≥11 y) using linear and ordered logistic regression. The Gross Motor Function Classification System level was included as a covariate in all analyses.
Results: There was no difference between age groups for preoperative to postoperative change in GDI, walking velocity, or FMS. The younger group significantly improved GDI, stride length, and global and upper extremity PODCI scores after SEMLS, while the older group significantly improved GDI only. The PODCI upper extremity subscale was the only variable impacted by age group (P=0.02).
Conclusion: Children with CP who undergo SEMLS at any age are likely to see improvements in the GDI. Those under 11 years at the time of SEMLS also show improvements in stride length and global and upper extremity PODCI scores, while those older than 11 years are likely to maintain but not improve their levels of activity and participation.
PMID: 40183243

9.Inducing asymmetric gait in healthy walkers: a review

Gert Van Der Velde, Henri Laloyaux, Renaud Ronsse

Review Front Rehabil Sci. 2025 Mar 17:6:1463382. doi: 10.3389/fresc.2025.1463382. eCollection 2025.

Abstract
Gait symmetry between both legs is a typical hallmark of healthy walking. In contrast, several pathologies induce asymmetry in the gait pattern, regarding both spatial and temporal features. This can be due to either an asymmetrical change of the body morphology-e.g., after an amputation or an injury-or a damage in the brain-such as stroke or cerebral palsy. This deficit in gait symmetry usually induces higher metabolic effort in locomotion and might further accelerate severe comorbidities such as osteoarthritis and low back pain. Consequently, several assistive devices-such as active exoskeletons or prostheses-are currently developed to mitigate gait asymmetry and restore a healthier gait pattern. Typically, the development of such devices requires extensive tests and validations, and it is practically and ethically not always desirable to recruit disabled patients to run these tests in the preliminary stages of development. In this review paper, we collect and analyse the different reversible interventions described in the literature that can induce asymmetry in the gait pattern of healthy walkers. We perform a systematic literature research by exploring five databases, i.e., Pubmed, Embase, Web of Science, Google Scholar, and Scopus. This narrative review identifies more than 150 articles reporting 16 different interventional methods used to induce asymmetric gait pattern in healthy walkers or with the potential to do so. These interventions are categorized according to their mode of action, and their effects on spatiotemporal parameters, joint kinematics and kinetics are summarized adopting a macroscopic viewpoint. Interventions are compared in terms of efficacy, maturity of the results, and applicability. Recommendations are provided for guiding researchers in the field in using each of the identified manipulations in its most relevant research contexts.
PMID: 40166454

10.Lower limb contracture definitions in children and adults with cerebral palsy: A systematic review

Andrea Marron, Jasmine Milnes, Laura Conry, Damien Kiernan

Review Gait Posture. 2025 Mar 30:120:1-8. doi: 10.1016/j.gaitpost.2025.03.027. Online ahead of print.

Aim: To examine the quantitative definitions and prevalence rates of fixed lower limb contractures in people with cerebral palsy (CP). Based on findings, to propose standardized values to define lower limb contractures to improve quality in future research.
Method: A systematic review was conducted according to PRISMA guidelines using 4 databases from inception to April 2024. Titles, abstracts, and full texts were independently screened. Data were extracted and quality assessed independently by 2 reviewers. Data were synthesized and presented descriptively.
Results: Forty-four studies were included. Ankle plantarflexion contracture definitions ranged from < 10° dorsiflexion to ≥ 20° plantarflexion, and prevalence rates ranged from 32 % to 90 %. Knee flexion contracture definitions ranged from > 0° to ≥ 30° flexion, and prevalence rates ranged from 19 % to 44 %. Hip flexion contracture definitions ranged from > 0° to ≥ 30° flexion, and prevalence rates ranged from 7 % to 68 %. Hip extension and abduction contractures were seldom defined.
Interpretation: There is considerable variability in reported contracture definitions and prevalence rates. Based on findings, we propose the following cut-offs for defining contractures; ankle plantarflexion contracture < 0° dorsiflexion, knee flexion contracture < 0° knee extension, hip flexion contracture < 0° hip extension, hip abduction contracture < 30° hip abduction, hip extension contracture ≤ 90° hip flexion range of motion.
PMID: 40179652

11.Study of the brain function characteristics in children with cerebral palsy during walking using functional near-infrared spectroscopy

Tengyu Zhang, Gongcheng Xu, Yajie Chang, Zichao Nie, Aiping Sun, Zengyong Li, Ping Xie

Neurophotonics . 2025 Apr;12(2):025004. doi: 10.1117/1.NPh.12.2.025004. Epub 2025 Mar 31.

Significance: Abnormal gait of children with cerebral palsy (CP) is caused by brain damage or developmental defects, exploring the brain's functional characteristics and regulatory mechanisms is essential for rehabilitation.
Aim: We aim to study the brain function characteristics in children with CP during walking.
Approach: The cortical activation, functional connectivity, information flow, and dynamic state transitions of 17 children with CP and 13 healthy children (HC) were analyzed in the resting and walking states.
Results: The motor cortex (MC) of HC is significantly activated in the walking state, whereas both the prefrontal cortex (PFC) and MC of children with CP are significantly activated. The resting brain functional connectivity of children with CP decreased and showed higher global efficiency and modularity and lower clustering coefficients and local efficiency. During walking, the brain network of children with CP was difficult to maintain a stable global high-connectivity state so the local high-connectivity state became the main connectivity state. For children with CP, more brain resources were allocated to the non-dominant MC during walking, whereas more brain resources were allocated to the dominant MC in HC.
Conclusions: These indicators reflect the characteristics of brain activation, network connectivity, and information regulation in children with CP, which provide the theoretical basis for targeted rehabilitation treatment.
PMID: 40166420

12.Efficacy of Plyometric Exercises Versus Wii Training on Upper Extremity Function in Children With Unilateral Cerebral Palsy: A Comparative Study

Sara S Saad-Eldien, Shamekh Mohamed El-Shamy, Asmaa O Sayed, Ahmed Abdelmoniem Ibrahim, Amira M Abd-Elmonem, Walaa A Abd El-Nabie, Heba H Abd-Elwahab, Faten Mohamed Hassan, Hanaa Mohsen Abd-Elfattah

NeuroRehabilitation . 2025 Apr 4:10538135251329220. doi: 10.1177/10538135251329220. Online ahead of print.

Abstract
ObjectivesTo compare between the effects of plyometric exercises versus Wii on upper extremity functions in children with unilateral cerebral palsy (UCP).MethodForty-two children with UCP, ranging in age from 8 to 12 years were allocated to receive plyometric exercises (PLYO -group) or Wii training (Wii-group) for 45 min. both groups received selected occupational therapy programs for 30 min twice a week over 3-month. The intervention was delivered on non-consecutive days. The quality of upper extremity skills test (QUEST), Test of arm selective control (TASC) and pneumatic squeeze bulb dynamometer were used to assess upper extremity function, SMC and HGS, respectively.ResultsOverall, 42 children (21 in the PLYO-group, 21 in the Wii-group) completed data collection and treatment. With-in group comparison showed significant improvement in both groups while post-treatment comparisons revealed a significant difference from mean difference in upper extremity function is 9.55 (8.71:10.39), SMC is 2.05 (1.47: 2.63) and HGS is 2.86 (2.20: 3.53) ($p < 0.05$; 95% Confidence interval) in favor of the PLYO-group.ConclusionsPlyometric exercises are significantly more effective than Wii training in improving upper extremity function and strength in children with UCP.
PMID: 40183392

13.Home-Based Telerehabilitation to Prevent Post-Modified Constraint-Induced Movement Therapy Regression in Unilateral Cerebral Palsy: A Randomized Controlled Trial

Youngsub Hwang, Won-Ho Shin, Sung-Eun Kim, Jeong-Yi Kwon

Phys Occup Ther Pediatr . 2025 Apr 3:1-18. doi: 10.1080/01942638.2025.2482257. Online ahead of print.

Aims: To determine the potential of low-end high-intensity home-based hand-arm bimanual intensive therapy (H-HABIT) in mitigating post-modified constraint-induced movement therapy (mCIMT) regression in children with unilateral cerebral palsy (UCP).
Methods: Twenty-two children (aged 4-12 years) with UCP were assigned to either the experimental (n = 12) or control group (n = 10). Both groups completed 30 h of mCIMT for three weeks, followed by 30 h of H-HABIT for five weeks in the experimental group and none in the control group. Assessments, including the assisting hand assessment (AHA) and other standardized measures, were performed at baseline, post-mCIMT, and post-H-HABIT. Triaxial accelerometers were worn on both wrists during each phase to monitor the activity.
Results: The experimental group showed AHA scores from baseline to post-H-HABIT, with a significant time × group interaction ($p = 0.001$, $\eta 2 = 0.29$) indicating distinct trajectories from the control. In contrast, actigraphy-based measures of the upper limb remained stable over time. Caregiver feedback for H-HABIT showed that 83.33% found the guidelines easy to follow, and 91.67% rated therapist interactions as helpful.
Conclusions: H-HABIT may help prevent post-mCIMT regression. Further research should refine task selection and explore advanced assessment methods to better capture real-world function.
PMID: 40177870

14.A Pilot Study of Listening Fatigue: Impacts of Pediatric Dysarthria on Adult Listeners

Jennifer U Soriano, Tristan J Mahr, Paul J Rathouz, Katherine C Hustad

Am J Speech Lang Pathol . 2025 Apr 4:1-16. doi: 10.1044/2024_AJSLP-24-00259. Online ahead of print.

Purpose: We sought to characterize fatigue of adults when listening to speech of children with cerebral palsy (CP).
Method: Fifty-seven children with CP (19 without dysarthria and 38 with dysarthria) produced single-word and multiword speech samples. One hundred fourteen adult listeners completed transcription intelligibility tasks and provided listening fatigue ratings. Multiword utterances were analyzed in terms of speech rate and communication efficiency.
Results: Intraclass correlations showed large individual differences for listening fatigue ratings. Pearson correlations showed negative relationships between listening fatigue and intelligibility; however, the magnitude varied depending upon utterance length and dysarthria status of child speakers. Pearson correlations between listening fatigue and speech rate and between listening fatigue and communication efficiency varied depending upon dysarthria status of child speakers. Welch's t test showed that listeners of children with dysarthria had higher fatigue ratings than listeners of children without dysarthria. Listeners of children with dysarthria were more fatigued following multiword utterances than single-word utterances. Best subset regression showed that the combined effect of dysarthria status, intelligibility, and speech rate best explained listening fatigue of adult listeners.
Conclusions: Listeners had increased levels of fatigue when they heard dysarthric speech relative to nondysarthric speech. The needs of both speaker and listener should be considered when supporting children with CP and dysarthria to achieve successful communication.
PMID: 40184585

15.Can we use lower extremity joint moments predicted by the artificial intelligence model during walking in patients with cerebral palsy in the clinical gait analysis?

Firooz Salami, Mustafa Erkam Ozates, Yunus Ziya Arslan, Sebastian Immanuel Wolf

PLoS One . 2025 Apr 1;20(4):e0320793. doi: 10.1371/journal.pone.0320793. eCollection 2025.

Abstract
Several studies have highlighted the advantages of employing artificial intelligence (AI) models in gait analysis. However, the credibility and practicality of integrating these models into clinical gait routines remain uncertain. This study critically evaluates an AI model's ability to predict lower extremity joint moments during gait in patients with cerebral palsy (CP). We employed a three-step approach to assess the feasibility of a previously developed AI model that predicted joint moments during walking for 622 patients with CP, using joint kinematics as input. First, we established clinically relevant thresholds for lower extremity joint moments, categorizing into three labels: acceptable (Green), acceptable with caution (Yellow), and unacceptable (Red). This categorization was based on the normalized root mean square error (nRMSE) between lab-measured and predicted joint moments. We explored the relationship between gait kinematics and joint moments by correlating the kinematic inputs with their respective output labels. Finally, we developed a linear discrimination analysis (LDA) model to predict labels for newly predicted joint. Assessing the validity of thresholds, an ANOVA one-way analysis and Bonferroni post -hoc statistical tests were performed to find significant differences between the nRMSE values for each label. The hip joint exhibited the largest population of Green labels (84%), while the ankle joint had the smallest (50%). Regressive differences in joint kinematics and gait profile scores were observed across all labels. The LDA model achieved an accuracy of 85.2% and an F-score of 92% for predicting Green label in hip joint moment. Additionally, more severe patient conditions were associated with an increase in Red-labeled predictions. Our findings highlight significant differences in nRMSE among labels, demonstrating the effectiveness of the proposed thresholds for labeling joint moments. Overall, the AI model's performance was rated as moderate, and the three-step approach proved valuable for assessing the feasibility of AI models in clinical settings.
PMID: 40168347

16.A streaming brain-to-voice neuroprosthesis to restore naturalistic communication

Kaylo T Littlejohn, Cheol Jun Cho, Jessie R Liu, Alexander B Silva, Bohan Yu, Vanessa R Anderson, Cady M Kurtz-Miott,

Samantha Brosler, Anshul P Kashyap, Irina P Hallinan, Adit Shah, Adelyn Tu-Chan, Karunesh Ganguly, David A Moses, Edward F Chang, Gopala K Anumanchipalli

Nat Neurosci . 2025 Mar 31. doi: 10.1038/s41593-025-01905-6. Online ahead of print.
Abstract
Natural spoken communication happens instantaneously. Speech delays longer than a few seconds can disrupt the natural flow of conversation. This makes it difficult for individuals with paralysis to participate in meaningful dialogue, potentially leading to feelings of isolation and frustration. Here we used high-density surface recordings of the speech sensorimotor cortex in a clinical trial participant with severe paralysis and anarthria to drive a continuously streaming naturalistic speech synthesizer. We designed and used deep learning recurrent neural network transducer models to achieve online large-vocabulary intelligible fluent speech synthesis personalized to the participant's preinjury voice with neural decoding in 80-ms increments. Offline, the models demonstrated implicit speech detection capabilities and could continuously decode speech indefinitely, enabling uninterrupted use of the decoder and further increasing speed. Our framework also successfully generalized to other silent-speech interfaces, including single-unit recordings and electromyography. Our findings introduce a speech-neuroprosthetic paradigm to restore naturalistic spoken communication to people with paralysis.
PMID: 40164740

17.Facilitators and barriers to implementation of early intensive manual therapies for young children with cerebral palsy across Canada

Divya Vurrabindi, Alicia J Hilderley, Adam Kirton, John Andersen, Christine Cassidy, Shauna Kingsnorth, Sarah Munce, Brenda Agnew, Liz Cambridge, Mia Herrero, Eleanor Leverington, Susan McCoy, Victoria Micek, Keith O Connor, Kathleen O' Grady, Sandra Reist-Asencio, Chelsea Tao, Stephen Tao, Darcy Fehlings

BMC Health Serv Res . 2025 Apr 4;25(1):503. doi: 10.1186/s12913-025-12621-z.

Background: Cerebral Palsy (CP) is the most common childhood-onset motor disability. Play-based early intensive manual therapies (EIMT) is an evidence-based practice to improve long-term hand function particularly for children with asymmetric hand use due to CP. For children under two years old, this therapy is often delivered by caregivers who are coached by occupational therapists (OTs). However, why only a few Canadian sites implement this therapy is unclear. There is a need to identify strategies to support implementation of EIMT. The primary objective of this study was to identify the facilitators and barriers to EIMT implementation from the perspectives of (1) caregivers of children with CP (2), OTs and (3) healthcare administrators for paediatric therapy programs.
Methods: The Consolidated Framework for Implementation Research (CFIR) was used to guide development of an online 5-point Likert scale survey to identify facilitators (scores of 4 and 5) and barriers (scores of 1 and 2) to implementation of EIMT. Three survey versions were co-designed with knowledge user partners for distribution to caregivers, OTs, and healthcare administrators across Canada. The five most frequently endorsed facilitators and barriers were identified for each respondent group.
Results: Fifteen caregivers, 54 OTs, and 11 healthcare administrators from ten Canadian provinces and one territory participated in the survey. The majority of the identified facilitators and barriers were within the 'Inner Setting' CFIR domain, with 'Structural Characteristics' emerging as the most reported CFIR construct. Based on the categorization of the most frequently endorsed facilitators and barriers within the CFIR domains, the key facilitators to EIMT implementation included the characteristics of the intervention and establishing positive workplace relationships and culture. The key barriers included having workplace restrictions on EIMT delivery models and external influences (e.g., funding) on EIMT uptake.
Conclusions: We identified key facilitators and barriers to implementing EIMT from a multi-level Canadian context. These findings will inform the next steps of designing evidence-informed and theory-driven implementation strategies to support increased delivery of EIMT for children under two years old with asymmetric hand use due to CP across Canada.
PMID: 40186231

18.The prevalence of long-term neurodevelopmental outcomes in preterm-born children in low- and middle-income countries: a systematic review and meta-analysis of developmental outcomes in 72 974 preterm-born children

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Meta-Analysis J Glob Health. 2025 Apr 4:15:04106. doi: 10.7189/jogh.15.04106.

Background: Preterm birth is associated with an increased risk of adverse neurodevelopmental outcomes. However, prevalence estimates of adverse neurodevelopmental outcomes on preterm born children in low - and middle - income countries (LMICs) remain unclear. In this systematic review and meta-analysis, we aim to estimate the prevalence of adverse neurodevelopmental outcomes in preterm-born children in LMICs.
Methods: We comprehensively searched six electronic databases - Medline, Embase, CINAHL, PsycInfo, Scopus, and Web of Science, without language and date restrictions. We included observational studies conducted in LMICs that reported prevalence of any type of neurodevelopmental outcome in children born preterm using a validated method or clinical diagnosis, and outcome measurement was performed in at least 100 eligible children at age ≥12 months. The primary outcomes of interest were a composite of any neurodevelopmental impairment, cerebral palsy, visual impairment/blindness, hearing impairment/ deafness, motor impairment, developmental delays, learning difficulties, and adverse behavioural and socio-emotional outcomes. We used the JBI critical appraisal checklist to assess the quality of the included studies, and prevalence estimates were calculated using a random-effects meta-analysis model.
Results: A total of 47 data sets from 12 countries involving 72 974 preterm-born children were included. The estimated pooled prevalence of overall neurodevelopmental impairment and cerebral palsy was 16% (95% confidence interval (CI) = 11-21%) and 5% (95% CI = 3-6%), respectively. The pooled prevalence of developmental delays across different domains ranged from 8 to 13%. Lower prevalence was found in hearing impairment/deafness and visual impairment/blindness (1%). Higher prevalences were observed with decreasing gestational age and birth weight.
Conclusions: There is a high burden of adverse neurodevelopmental outcomes in preterm born children in LMICs. Such prevalence estimates are essential in informing clinical and public health policy, allocating scarce resources, and directing further research to improved outcomes in these settings.
Registration: PROSPERO: CRD42024569564.
PMID: 40181744

19.Social support, depression, and quality of life among parents of children with cerebral palsy in Benin, West Africa: a cross-sectional case-control study

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Abstract
Caring for a child with cerebral palsy (CP) is challenging and can significantly impact caregivers' quality of life. This study aimed to examine the psychological state, perceived social support, and quality of life of parents of children with CP in Benin, West Africa. This cross-sectional, case-control design included 50 parents of children with CP (mean age 39.4 ± 8.3 years, 46 mothers) paired with 58 parents of typically developing children (mean age 38.1 ± 7.4 years, 52 mothers) as controls. Both groups completed the Social Provisions Scale (SPS-10), Patient Health Questionnaire-9 (PHQ-9), and Medical Outcome Study Short Form (SF-12) to assess social support, depression, and quality of life. Additionally, parents of children with CP completed the Impact on Family Scale to evaluate caregiving burden. The results showed that parents of children with CP reported lower social support and higher depression levels than controls ($P < 0.05$). However, their quality of life (both physical and mental scores) was similar to the control group ($P > 0.05$). Only depression was significantly linked to lower quality of life ($P < 0.05$) in parents of children with CP. In conclusion, parents of children with CP have a comparable physical and mental health-related quality of life to parents of typically developing children, despite experiencing lower perceived social support and higher levels of depression in Benin country. These findings underscore the need for enhanced social and psychological support systems to improve the well-being of families caring for children with CP in such environments.
PMID: 40177959

20.Reliability and validity of the Mini-Eating and Drinking Ability Classification System (Mini-EDACS) among Dutch preschoolers with cerebral palsy

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Abstract
Purpose This study aimed to translate the English version of the Mini-Eating and Drinking Ability Classification System (Mini-EDACS) into Dutch and assess its psychometric properties and applicability among preschool-aged children with cerebral palsy (CP) in the Netherlands.MethodsForty-eight children with CP (18-36 months) were included. Inter-rater reliability of the Dutch version of the Mini-EDACS was assessed between two speech and language therapists (SLTs) and between two SLTs and parents. Construct validity was established by hypothesis testing regarding the expected strength of the correlation between Mini-EDACS level and sum score of (a) the Pediatric Eating Assessment Tool (PEDI-EAT-10) and (b) the Montreal Children's Hospital Feeding Scale (MCH-FS).ResultsThe level of agreement for Mini-EDACS level was almost perfect between SLTs (weighted kappa (kw) = 0.83) and substantial between parents and SLTs (parents vs SLT-1: kw = 0.77; parents vs SLT-2: kw = 0.70).Kendall's tau-b correlation between Mini-EDACS and PEDI-EAT-10 was 0.66 ($p < 0.001$), slightly lower than hypothesized, and 0.52 ($p < 0.001$) between Mini-EDACS and MCH-FS, aligning with the hypothesis. Applicability was found to be good.ConclusionThe Dutch version of the Mini-EDACS showed sufficient inter-rater reliability, construct validity and applicability and can be used in clinical care in the Netherlands to promote unambiguous communication between healthcare professionals and parents.
PMID: 40170383

21.Genetic testing in cerebral palsy with clinical and neuroimaging variables

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Aim: To optimize genetic testing in children with cerebral palsy (CP) by using clinical and magnetic resonance imaging (MRI) variables.
Method: In this mixed methods study, we surveyed current approaches to genetic testing by Australian clinicians involved in the diagnosis of CP. Using an international expert panel we explored 78 variables, to determine which variables were thought to be supportive of monogenic CP. We tested the 78 variables in a retrospective cohort of 100 children with CP, of whom 21 had a genetic cause of CP.
Results: Forty-five clinicians replied to the survey of current practice, 91% agreed that genetic testing has a role in CP, although 47% thought that there was inadequate guidance on which patients to test. The expert panel reached 75% agreement for 30 out of 78 variables for genetic CP, and 14 out of 78 variables against a genetic cause of CP. Retrospective testing in 100 children with CP revealed dysmorphic features (odds ratio [OR] = 7.50; 95% confidence interval [CI] 1.88-29.85) and intellectual disability (OR = 4.86; 95% CI 1.29-18.30) were more common in those with genetic CP, and MRI being compatible with the clinical picture was the feature least common in genetic CP (OR = 0.14; 95% CI 0.05-0.41).
Interpretation: Genetic testing has a role in determining CP aetiology; however, there is no consensus on who should be tested. We used mixed methodology and found that dysmorphic features, intellectual disability, and 'MRI not compatible with the clinical picture' are most supportive of a genetic cause of CP.
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