Cerebral palsy research news

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Professor Nadia Badawi AM
CP Alliance Chair of Cerebral Palsy Research

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Interventions and Management

1. Fast and Fun: A Pilot Feasibility Study Using Dual Joystick-Operated Ride-on Toys for Upper Extremity Rehabilitation in Children with Hemiplegia

Vaishnavi Shahane, Patrick D Kumavor, Kristin Morgan, Sudha Srinivasan

Phys Occup Ther Pediatr. 2024 Jun 11:1-21. doi: 10.1080/01942638.2024.2360462. Online ahead of print.

Aim: Our study investigates the feasibility and utility of implementing a dual joystick-operated ride-on-toy navigation training (RNT) program within a 3-week intensive camp based on principles of modified constraint-induced movement therapy and bimanual training, to improve upper extremity (UE) function in children with unilateral cerebral palsy (UCP). Methods: We employed a single-group pretest posttest, mixed methods study design. Eleven 4-to-10-year-old children with UCP received RNT as part of camp activities. Sessions required children to use both arms together for navigation and completing gross and fine motor UE challenges. We collected exit questionnaires from children, caregivers, and clinicians to assess the feasibility, acceptance, enjoyment, and perceived efficacy of RNT. Videos of training sessions were coded using Datavyu behavioral coding software to assess children's facial expressions and affective states, indicative of their level of engagement during intervention sessions. Results: We found high levels of child engagement during RNT sessions based on video data and stakeholder feedback. The RNT program was smoothly integrated into the camp. Stakeholders acknowledged the highly motivating nature of RNT. When combined with other camp activities, the program led to stakeholder-reported improvements in bimanual skills and spontaneous daily use of the affected UE. Conclusions: Our pilot study provides promising evidence for using joystick-operated ride-on toys as engaging therapy adjuncts. Our findings call for future studies to systematically assess the efficacy of these devices in improving UE function among children with UCP.

PMID: 38863174

2. Spinal manipulation and mobilisation in paediatrics - an international evidence-based position statement for physiotherapists

Anita R Gross, Kenneth A Olson, Jan Pool, Annalie Basson, Derek Clewley, Jenifer L Dice, Nikki Milne

Review J Man Manip Ther. 2024 Jun 10:1-23. doi: 10.1080/10669817.2024.2332026. Online ahead of print.

Introduction: An international taskforce of clinician-scientists was formed by specialty groups of World Physiotherapy - International Federation of Orthopaedic Manipulative Physical Therapists (IFOMPT) & International Organisation of Physiotherapists in Paediatrics (IOPTP) - to develop evidence-based practice position statements directing physiotherapists clinical reasoning for the safe and effective use of spinal manipulation and mobilisation for paediatric populations (<18 years) with varied musculoskeletal or non-musculoskeletal conditions. Method: A three-stage guideline process using validated methodology was completed: 1. Literature review stage (one scoping review, two reviews exploring psychometric properties); 2. Delphi stage (one 3-Round expert Delphi survey); and 3. Refinement stage (evidence-to-decision summative analysis, position statement development, evidence gap map analyses, and multilayer review processes). Results: Evidence-based practice position statements were developed to guide the appropriate use of spinal manipulation and mobilisation for paediatric populations. All were predicated on clinicians using biopsychosocial clinical reasoning to determine when the

intervention is appropriate.1. It is not recommended to perform:• Spinal manipulation and mobilisation on infants.• Cervical and lumbar spine manipulation on children.•Spinal manipulation and mobilisation on infants, children, and adolescents for non-musculoskeletal paediatric conditions including asthma, attention deficit hyperactivity disorder, autism spectrum disorder, breastfeeding difficulties, cerebral palsy, infantile colic, nocturnal enuresis, and otitis media.2. It may be appropriate to treat musculoskeletal conditions including spinal mobility impairments associated with neck-back pain and neck pain with headache utilising:• Spinal mobilisation and manipulation on adolescents;• Spinal mobilisation on children; or• Thoracic manipulation on children for neck-back pain only.3. No high certainty evidence to recommend these interventions was available.Reports of mild to severe harms exist; however, risk rates could not be determined. Conclusion: Specific directives to guide physiotherapists' clinical reasoning on the appropriate use of spinal manipulation or mobilisation were identified. Future research should focus on trials for priority conditions (neck-back pain) in children and adolescents, psychometric properties of key outcome measures, knowledge translation, and harms.

PMID: 38855972

3. Surgical complications in neuromuscular scoliosis surgery: systematic review and meta-analysis of the last ten years

Mostafa Ali Elmeshneb, Mohamed A Hassanin, Belal Elnady, Ahmed Sleem, Giang Truong Le, Mohammed Shakil Patel, N A Quraishi

Review Eur Spine J. 2024 Jun 13. doi: 10.1007/s00586-024-08338-y. Online ahead of print.

Purpose: Surgical correction of neuromuscular scoliosis is often a challenging and extensive procedure. Due to this complexity and the high disease burden that these patients carry, per and post-operative complications are not uncommon. The purpose of this study was to systematically review and describe the pooled rates of postoperative complications and analyze risk factors for complications in neuromuscular scoliosis surgery described in the literature in the last ten years. Methods: A systematic review of the English literature across multiple databases was conducted using search criteria (neuromuscular scoliosis AND complications) and using PRISMA guidelines (Jan 2012-July 2022). Studies with less than 30 patients and follow-up of < 2 years were excluded. Data extraction and meta-analysis were performed using random mode effect. Statistical analysis was conducted using OpenMeta software. Meta-regression analysis was used to detect risk factors (surgical approach, intraoperative time, intraoperative blood loss, preoperative Cobb angle and patient diagnosis) associated with each complication group. Confidence interval (CI) was set at 95%. Results: Twenty-two studies met the inclusion criteria involving 2155 patients. The level of evidence among studies were III (9) and IV (13). The most common primary diagnosis was cerebral palsy (43%) followed by Duchenne muscle dystrophy (20%), myelomeningocele (7.4%), spinal muscle atrophy (7.1%), Rett syndrome (< 2%) and combined other pathologies (20.2%). The pooled incidence rate of wound complications was the highest, amongst all complications, at 13.3% (CI 10.838 to 16.861); closely followed by respiratory complications (11.8%;CI 5.7 to 19.7). Implant failure occurred in 7.1% cases (CI 6.418 to 11.465), gastrointestinal complications was 5.2%; CI 2.4 to 8), pseudarthrosis in (4.6%;CI 2.2 to 6.9) and neurological deficit in 2.9% (CI 1.989 to 6.086). The pooled rate of revision surgery was (9.6%; CI 6.2 to 12.9). Heterogeneity was assessed using I2 test which results were moderately heterogeneous. Meta-regression analysis revealed that the diagnosis of myelomeningocele or Duchenne muscle dystrophy or spinal muscle atrophy were strongly associated with wound and respiratory complications ($p = 0.007$ and $p = 0.005$, respectively). Conclusion: Wound-related (13.3%) and respiratory complications (11.8%) remain the most common complications among studies after corrective surgery for neuromuscular scoliosis. Both are significantly associated with Duchenne muscle dystrophy, spinal muscle atrophy and myelomeningocele.

PMID: 38869648

4. Severe rigid hip flexion-abduction contracture in cerebral palsy: a case report and review of the literature [Abstract in English, Spanish]

A Ramírez-Barragán, M Galán-Olleros, R M Egea-Gámez, A Palazón-Quevedo, I Martínez-Caballero

Review Acta Ortop Mex. 2024 May-Jun;38(3):197-201. doi: 10.35366/115816.

Introduction: severe, rigid hip abduction deformity in individuals with cerebral palsy (CP) is an exceptionally uncommon condition. This posture hinders the positioning in the wheelchair and the completion of basic activities of daily living (ADL). Addressing such severe deformities can be quite challenging. Material and methods: a 14-year-old male, with spastic-dystonic quadriplegic CP, developed rigid and severe flexion-abduction contractures in both hips, characterized by 90 degrees of flexion and 100 degrees of abduction. These contractures severely impeded his ability to comfortably use a wheelchair and even pass through doorways. Performing basic ADLs became a significant challenge for both the patient and his caregivers. Results: the treatment approach involved a two-stage surgical procedure, one for each hip, with a two-month interval between them. An extensive release of the fascia latae, gluteus maximus, external rotators, and hip flexors; in combination with a proximal femur osteotomy were performed. To maintain the corrections achieved, long-leg casts connected with two bars were employed, followed by orthotic support and physiotherapy. Following the procedure, lower limb adduction was achieved, and the patient and caregivers were highly satisfied, as ADLs and basic caregiving had been greatly facilitated. Conclusions: while the available literature on the management of severe rigid abduction hip contractures in non-ambulatory CP patients is limited, and

treatment options are often complex, the present case underscores the effectiveness of a comprehensive approach involving soft tissue release and bone surgery. Achieving a more favorable wheelchair positioning and facilitating basic ADLs and care represents a significant success for patients and families.

PMID: 38862151

5. Combined translational and rotational perturbations of standing balance reveal contributions of reduced reciprocal inhibition to balance impairments in children with cerebral palsy

Jente Willaert, Kaat Desloovere, Anja Van Campenhout, Lena H Ting, Friedl De Groote

PLoS Comput Biol. 2024 Jun 13;20(6):e1012209. doi: 10.1371/journal.pcbi.1012209. Online ahead of print.

Balance impairments are common in cerebral palsy. When balance is perturbed by backward support surface translations, children with cerebral palsy have increased co-activation of the plantar flexors and tibialis anterior muscle as compared to typically developing children. However, it is unclear whether increased muscle co-activation is a compensation strategy to improve balance control or is a consequence of reduced reciprocal inhibition. During translational perturbations, increased joint stiffness due to co-activation might aid balance control by resisting movement of the body with respect to the feet. In contrast, during rotational perturbations, increased joint stiffness will hinder balance control as it couples body to platform rotation. Therefore, we expect increased muscle co-activation in response to rotational perturbations if co-activation is caused by reduced reciprocal inhibition but not if it is merely a compensation strategy. We perturbed standing balance by combined backward translational and toe-up rotational perturbations in 20 children with CP and 20 TD children. Perturbations induced forward followed by backward movement of the center of mass. We evaluated reactive muscle activity and the relation between center of mass movement and reactive muscle activity using a linear feedback model based on center of mass kinematics. In typically developing children, perturbations induced plantar flexor balance correcting muscle activity followed by tibialis anterior balance correcting muscle activity, which was driven by center of mass movement. In children with cerebral palsy, the switch from plantar flexor to tibialis anterior activity was less pronounced than in typically developing children due to increased muscle co-activation of the plantar flexors and tibialis anterior throughout the response. Our results thus suggest that a reduction in reciprocal inhibition causes muscle co-activation in reactive standing balance in children with CP.

PMID: 38870205

6. Correction to: Effectivenness of assisted standing on bone mineral density in children with cerebral palsy. A systematic review [Article in English, Spanish]

Fernando Valenzuela-Aedo, Camila Reyes-Moreno, Teresa Balboa-Castillo

Published Erratum Arch Argent Pediatr. 2024 Jun 13:e202410458. doi: 10.5546/aap.2024-10458.eng. Online ahead of print.

No abstract available

Erratum for
Effectiveness of assisted standing on bone mineral density in children with cerebral palsy. A systematic review.
Valenzuela-Aedo F, Reyes-Moreno C, Balboa-Castillo T.
Arch Argent Pediatr. 2024 Apr 4:e202310251. doi: 10.5546/aap.2023-10251.eng. Online ahead of print.
PMID: 38527242

PMID: 38861644

7. Mobile digital gait analysis captures effects of botulinum toxin in hereditary spastic paraplegia

Alzhraa A Ibrahim, Malte Ollenschläger, Stephan Klebe, Rebecca Schüle, Nicole Jeschonneck, Melanie Kellner, Evelyn Loris, Teresa Greinwalder, Bjoern M Eskofier, Jürgen Winkler, Heiko Gaßner, Martin Regensburger

Eur J Neurol. 2024 Jun 10:e16367. doi: 10.1111/ene.16367. Online ahead of print.

Background and purpose: Hereditary spastic paraplegias (HSPs) comprise a group of inherited neurodegenerative disorders characterized by progressive spasticity and weakness. Botulinum toxin has been approved for lower limb spasticity following stroke and cerebral palsy, but its effects in HSPs remain underexplored. We aimed to characterize the effects of botulinum toxin on clinical, gait, and patient-reported outcomes in HSP patients and explore the potential of mobile digital gait analysis to monitor treatment effects and predict treatment response. Methods: We conducted a prospective, observational, multicenter study involving ambulatory HSP patients treated with botulinum toxin tailored to individual goals. Comparing data at baseline, after 1 month, and after 3 months, treatment response was assessed using clinical parameters, goal attainment scaling, and mobile digital gait analysis. Machine learning algorithms were used for predicting individual goal attainment based on baseline

parameters. Results: A total of 56 patients were enrolled. Despite the heterogeneity of treatment goals and targeted muscles, botulinum toxin led to a significant improvement in specific clinical parameters and an improvement in specific gait characteristics, peaking at the 1-month and declining by the 3-month follow-up. Significant correlations were identified between gait parameters and clinical scores. With a mean balanced accuracy of 66%, machine learning algorithms identified important denominators to predict treatment response. Conclusions: Our study provides evidence supporting the beneficial effects of botulinum toxin in HSP when applied according to individual treatment goals. The use of mobile digital gait analysis and machine learning represents a novel approach for monitoring treatment effects and predicting treatment response.

PMID: 38859620

8. Exploring the rationale for prescribing ankle-foot orthoses and supramalleolar orthoses in children with cerebral palsy: A narrative synthesis of rationale statements

Asumi H Dailey, Jessica Landers, Sarah Anderson, Michael P Dillon

Review Prosthet Orthot Int. 2024 Jun 1;48(3):290-299. doi: 10.1097/PXR.0000000000000282. Epub 2023 Oct 13.

Background: To help improve outcomes for children with cerebral palsy (CP), ankle-foot orthoses (AFOs) and supramalleolar orthoses (SMOs) are prescribed. However, it is not clear why one intervention is prescribed over the other. Objectives: To explore the rationale for prescribing AFOs and SMOs in children with CP and its link to the choice of outcome measure used. Study design: Narrative review. Methods: Six databases were searched (eg, Medline) and data extracted from articles that met the inclusion criteria. Data describing the participant demographics, type of orthosis, and outcome measures used were summarized to provide context for the different rationale for orthotic prescription that were thematically analyzed. Discussion: Forty-seven articles were included. Participants were aged 9 ± 2 years, 59% were male, 79% had diplegia, and 38% were classified as Gross Motor Function Classification System level I. All studies included a rationale for prescribing AFOs that, in most cases, reflected the outcome measures used. These rationale statements were synthesized into 5 specific themes (e.g., reduced energy expenditure and metabolic costs). By comparison, 5 of these studies described the rationale for providing SMOs, and of those that did, most of the rationale statements were nonspecific. Conclusions: A large and contemporary body of literature describes the rationale for prescribing AFOs for children with CP. There are opportunities for future research that clearly articulates the rationale for prescribing SMOs for children living with CP and to focus the rational for orthotic intervention on the real-world challenges that are most important to children living with CP, such as the ability to participate among peers.

PMID: 38857165

9. Sit-to-stand performance in children with cerebral palsy: a population-based cross-sectional study

Elinor Romin, Anna Lindgren, Elisabet Rodby-Bousquet, Erika Cloodt

BMC Musculoskelet Disord. 2024 Jun 11;25(1):460. doi: 10.1186/s12891-024-07557-0.

Background: Sit-to-stand (STS) is one of the most commonly performed functional movements in a child's daily life that enables the child to perform functional activities such as independent transfer and to initiate walking and self-care. Children with cerebral palsy (CP) often have reduced STS ability. The aim of this study was to describe STS performance in a national based total population of children with CP and its association with age, sex, Gross Motor Function Classification System (GMFCS) level, and CP subtype. Methods: This cross-sectional study included 4,250 children (2,503 boys, 1,747 girls) aged 1-18 years from the Swedish Cerebral Palsy Follow-Up Program (CPUP). STS performance was classified depending on the independence or need for support into "without support," "with support," or "unable." "With support" included external support from, e.g., walls and furniture. Physical assistance from another person was classified as "unable" (dependent). Ordinal and binary logistic regression analyses were used to identify associations between STS and age, GMFCS level, and CP subtype. Results: 60% of the children performed STS without support, 14% performed STS with support, and 26% were unable or needed assistance from another person. STS performance was strongly associated with GMFCS level and differed with age and subtype ($p < 0.001$). For all GMFCS levels, STS performance was lowest at age 1-3 years. Most children with GMFCS level I (99%) or II (88%) performed STS without support at the age of 4-6 years. In children with GMFCS level III or IV, the prevalence of independent STS performance improved throughout childhood. CP subtype was not associated with STS performance across all GMFCS levels when adjusted for age. Conclusions: Independent STS performance in children with CP is associated with GMFCS level and age. Children with CP acquire STS ability later than their peers normally do. The proportion of children with independent STS performance increased throughout childhood, also for children with GMFCS level III or IV. These findings suggest the importance of maintaining a focus on STS performance within physiotherapy strategies and interventions for children with CP, including those with higher GMFCS level.

PMID: 38862936

10. The Impact of Botulinum Toxin Combined with Robot-Assisted Gait Training on Spasticity and Gross Motor Function on Children with Spastic Cerebral Palsy

Panfeng Jin, Yiwen Wang

Dev Neurorehabil. 2024 Jun 13:1-6. doi: 10.1080/17518423.2024.2365801. Online ahead of print.

Objective: To evaluate the impact of combining botulinum toxin-A (BoNT-A) injection with robot-assisted gait training (RAGT) on lower limb spasticity and motor function in children with cerebral palsy. Methods: A prospective study was conducted from January 2020 to January 2023, including 68 patients. Twenty patients received the combination of BoNT-A injection and RAGT, while 48 received BoNT-A injection alone. Assessments were performed before the intervention and at 1, 3, and 6 months post-injection using the Modified Tardieu Scale (MTS), sections D and E of the Gross Motor Function Measure-88 (GMFM-88), 6-minute walk test (6MWT), and 10-meter walk test (10MWT). Results: Compared to the control group receiving BoNT-A alone, the combination of BoNT-A and RAGT did not significantly improve spasticity-related outcomes, including MTS scores, R1, and R2 angles ($p > .05$). However, the combination group demonstrated significantly improved gross motor function, particularly in walking, running (GMFM-E), short-term walking endurance (6MWT), and walking speed (10MWT) in children with cerebral palsy after the intervention ($p < .05$). Conclusion: While the addition of RAGT did not enhance the anti-spasticity effects of BoNT-A, it significantly improved gross motor function and walking abilities in children with cerebral palsy.

PMID: 38867662

11. Effects of routine physical therapy with and without kinesio taping in improving gross motor function in sitting and standing in spastic diplegic cerebral palsy children

Zain Ul Abbas, Umair Ahmed, Faiza Sharif, Kashif Siddique, Syeda Shan E Fatima, Mohsin Ajmal

Randomized Controlled Trial J Bodyw Mov Ther. 2024 Jul:39:666-672. doi: 10.1016/j.jbmt.2023.11.049. Epub 2023 Dec 9.

Objective: To determine the effectiveness of Kinesio taping along with routine physical therapy on improving gross motor function in sitting and standing among spastic diplegic Cerebral Palsy children. Design: Randomized controlled trial. Settings: University Teaching Hospital University of Lahore, Lahore. Participants: 53 participants with diagnosed spastic diplegic cerebral palsy were randomly allocated in control and experimental groups. Intervention: 26 Participants were treated by kinesio taping which was applied in a criss-cross manner along with routine physical therapy program while the control group (n = 27) received NDT exercise program that comprises of stretching, functional reaching, weight-bearing exercises and walking. Outcome measure: Gross motor function was assessed using 2 components of Gross Motor Function Classification System (GMFCS-88), i.e., sitting as well as standing at the base line and after every 3rd week for 12 weeks follow up. Results: In study and control group the mean score of gross motor function for sitting at baseline was 33.96 ± 3.11 and 31.50 ± 3.32 respectively. After intervention, it changed to 47.70 ± 5.46 and 43.46 ± 1.81 respectively. Mean score for Gross Motor Function calculated at base line in study and control group for standing was 27.37 ± 1.14 and 26 ± 3.01 respectively. At the end of intervention, the score improved to 36.55 ± 4.27 and 33.69 ± 2.46 respectively. Conclusion: In comparison to control group, significant increase in gross motor function of intervention group was seen after the 12 weeks of intervention. In this way, over back muscles the application of kinesio tape in a Criss-Cross manner may be helpful. Also it can be used as an additional approach along with routine physical therapy to improve standing and sitting in spastic diplegic children.

PMID: 38876700

12. Limited associations between passive range of motion and gross motor function in ambulant/semi-ambulant children and adolescents with cerebral palsy: A cross-sectional study

Christina Esmann Fonvig, Jens Troelsen, Ulrich Halekoh, Anders Holsgaard-Larsen

J Bodyw Mov Ther. 2024 Jul:39:170-175. doi: 10.1016/j.jbmt.2024.02.030. Epub 2024 Mar 6.

Background and aim: Cerebral palsy (CP) is the most common childhood motor disability, and the Cerebral Palsy Follow-Up Program (CPUP) in Nordic countries uses a traffic light system for passive range of motion (ROM) assessment to aid interpretation and guide decisions regarding interventions. However, the arbitrary chosen ROM threshold values and their potential clinical impact are uncertain. We investigated whether lower extremity ROM values were positively associated with gross motor function and whether gross motor function scores differ between the CPUP ROM thresholds. Methods: This was a cross-sectional analysis of CPUP data for 841 ambulatory children and adolescents with CP, at a mean (SD) age of 9 (3). Regression analyses were employed to explore the relationship between gross motor capacity and performance (using the Gross Motor Function Measure (GMFM-66) and the Functional Mobility Scale (FMS) 5/50/500 m, respectively) and lower extremity ROM, measured with a goniometer. ROM was assessed both as continuous and categorical variables. Results: We found that two out of ten continuous ROM measures were positively associated with gross motor function. Limited differences in gross motor function between the ROM thresholds were seen for seven out of ten ROM measures. The CPUP traffic light thresholds

primarily differentiated gross motor function between the red and green categories, predominantly for the subgroup of participants with bilateral spastic CP. Conclusion: Limited associations between passive ROM and gross motor function in children and adolescents with CP were observed, indicating that there is more to consider than ROM when identifying whether interventions are needed.

PMID: 38876622

13. A new methodological approach to characterize selective motor control in children with cerebral palsy

Valentina Graci, Mitchel O'Neill, Meredith Bloss, Rahul Akkem, Athylia C Paremski, Ozell Sanders, Laura A Prosser

Front Hum Neurosci. 2024 May 30:18:1330315. doi: 10.3389/fnhum.2024.1330315. eCollection 2024.

Introduction: Despite being a primary impairment in individuals with cerebral palsy (CP), selective motor control (SMC) is not routinely measured. Personalized treatment approaches in CP will be unattainable without the ability to precisely characterize the types and degrees of impairments in motor control. The objective of this study is to report the development and feasibility of a new methodological approach measuring muscle activation patterns during single-joint tasks to characterize obligatory muscle co-activation patterns that may underly impaired SMC. Methods: Muscle activation patterns were recorded during sub-maximal voluntary isometric contraction (sub-MVIC) tasks at the hip, knee, and ankle with an interactive feedback game to standardize effort across participants. We calculated indices of co-activation, synergistic movement, mirror movement, and overflow (indices range 0-2, greater scores equal to greater impairment in SMC) for each isolated joint task in 15 children - 8 with typical development (TD) (mean age 4.7 ± 1.0 SD years) and 7 with CP (mean age 5.8 ± 0.7 SD years). Indices were compared with Mann-Whitney tests. The relationships between the indices and gross motor function (GMFM-66) were examined with Pearson's r. Results: Mean indices were higher in the CP vs. the TD group for each of the six tasks, with mean differences ranging from 0.05 (abduction and plantarflexion) to 0.44 (dorsiflexion). There was great inter-subject variability in the CP group such that significant group differences were detected for knee flexion mirroring ($p = 0.029$), dorsiflexion coactivation ($p = 0.021$), and dorsiflexion overflow ($p = 0.014$). Significant negative linear relations to gross motor function were found in all four indices for knee extension ($r = -0.56$ to -0.75), three of the indices for ankle dorsiflexion ($r = -0.68$ to -0.78) and in two of the indices for knee flexion ($r = -0.66$ to -0.67), and ankle plantarflexion ($r = -0.53$ to -0.60). Discussion: Indices of coactivation, mirror movement, synergy, and overflow during single-joint lower limb tasks may quantify the type and degree of impairment in SMC. Preliminary concurrent validity between several of the indices of SMC and gross motor function was observed. Our findings established the feasibility of a new methodological approach that quantifies muscle activation patterns using electromyography paired with biofeedback during single-joint movement.

PMID: 38873651

14. Measurement properties and feasibility of chronic pain assessment tools for use with children and young people with cerebral palsy

Nadine L Smith, Noula Gibson, Natasha Bear, Ashleigh L Thornton, Christine Imms, Meredith G Smith, Adrienne R Harvey

Review Disabil Rehabil. 2024 Jun 10:1-15. doi: 10.1080/09638288.2024.2362398. Online ahead of print.

Purpose: Chronic pain assessment tools exist for children, but may not be valid, reliable, and feasible for populations with functional, cognitive or communication limitations, for example, cerebral palsy (CP). This study aimed to (i) identify chronic pain assessment tools used with children and young people and rate their measurement properties; (ii) develop a CP specific feasibility rating tool to assess the feasibility of tools in CP; and (iii) categorise tools according to reporting method. Materials and methods: Assessment tools were identified by literature review. Their measurement properties were rated using the COnsensus based standards for the Selection of health Measurement INstruments. The CP specific Feasibility Rating Tool was developed and used to rate the tools. Results: Fifty-seven chronic pain assessment tools were identified. Six have content validity for CP, four of these use proxy-report. Forty-two tools were considered feasible for people with CP; 24 self report and 18 observational/proxy-report. Only the Paediatric Pain Profile has content validity and feasibility for people with CP unable to self-report. Conclusions: There are few valid, reliable and feasible tools to assess chronic pain in CP. Further research is required to modify tools to enable people with cognitive limitations and/or complex communication to self-report pain.

PMID: 38856092

15. Chronic pain in children and young people with cerebral palsy: a narrative review of challenges, advances, and future directions

Adrienne Harvey, Nadine Smith, Meredith Smith, Katarina Ostojic, Carolyn Berryman

Review BMC Med. 2024 Jun 11;22(1):238. doi: 10.1186/s12916-024-03458-0.

Background: Cerebral palsy (CP), the most common physical disability of childhood, is often accompanied by a range of comorbidities including pain. Pain is highly prevalent in children and young people with CP, yet has been poorly understood, inaccurately assessed, and inadequately managed in this vulnerable population. This narrative review presents recent research advances for understanding and managing pain in children and young people with CP, focusing on chronic pain, and highlights future research directions. Main body: Pain prevalence rates in CP vary due to different methodologies of studies. Recent systematic reviews report up to 85% of children experience pain; higher in older children, females, and those with dyskinesia and greater motor impairment. Research examining the lived experience perspectives of children and their families demonstrate that even those with mild motor impairments have pain, children want to self-report pain where possible to feel heard and believed, and management approaches should be individualized. Notably, many children with cognitive and communication impairments can self-report their pain if adjustments are provided and they are given a chance. Past inadequacies of pain assessment in CP relate to a focus on pain intensity and frequency with little focus on pain interference and coping, a lack of tools appropriate for the CP population, and an assumption that many children with cognitive and/or communication limitations are unable to self-report. Recent systematic reviews have identified the most reliable and valid assessment tools for assessing chronic pain. Many were not developed for people with CP and, in their current form, are not appropriate for the spectrum of physical, communication, and cognitive limitations seen. Recently, consensus and co-design in partnership with people with lived experience and clinicians have identified tools appropriate for use in CP considering the biopsychosocial framework. Modifications to tools are underway to ensure feasibility and applicability for the spectrum of abilities seen. Conclusion: Recent research advances have improved our understanding of the prevalence, characteristics and lived experience of chronic pain, and refined assessment methods in children and young people with CP. However, the very limited evidence for effective and novel management of chronic pain in this population is where research should now focus.

PMID: 38862988

16. "Your Thoughts are (were) Free!": Brain-Computer-Interfaces, Neurofeedback, Detection of Deception, and the Future of Mind-Reading

Niels Birbaumer

Review Appl Psychophysiol Biofeedback. 2024 Jun 14. doi: 10.1007/s10484-024-09648-z. Online ahead of print.

This review describes the historical developement and rationale of clinically relevant research on neurophysiological "mind reading" paradims: Brain- Computer-Interfaces, detection of deception, brain stimulation and neurofeedback and the clinical applications in drug resistant epilepsy, chronic stroke, and communication with paralyzed locked-in persons. The emphasis lies on completely locked-in patients with amyotrophic lateral sclerosis using non-invasive and invasive brain computer interfaces and neurofeedback to restore verbal communication with the social environment. In the second part of the article we argue that success and failure of neurophysiological "mind reading" paradigms may be explained with a motor theory of thinking and emotion in combination with learning theory. The ethical implications of brain computer interface and neurofeedback approaches, particularly for severe chronic paralysis and loss of communication diseases and decisions on hastened death and euthanasia are discussed.

PMID: 38874845

17. Is Assisted Reproductive Technology linked to fetal asphyxia? A retrospective Italian case control study

Osella Elena, Aquino Carmen Imma, Colagiorgio Sofia, Amadori Roberta, Grandioso Sara, Remorgida Valentino, Surico Daniela

J Obstet Gynaecol Can. 2024 Jun 7:102577. doi: 10.1016/j.jogc.2024.102577. Online ahead of print.

Several risk factors are associated with fetal asphyxia. The main aim of this retrospective, analytical, case-control study was to determine whether assisted reproductive technologies (ART) could be considered one of these factors. 162 cases with fetal asphyxia were compared to 361 controls where this event did not occur. We included 32 ART pregnancies, of which 12 obtained through egg donations. 75% (24) of the ART pregnancies experienced fetal asphyxia, suggesting ART increases the risk of fetal asphyxia by about 7 times. This finding is consistent with the literature. The pathogenesis of fetal asphyxia in ART pregnancies is currently unknown. Accordingly, this topic should be further investigated.

PMID: 38852807

18. Risk Factor Predictors for Developing Epilepsy in Cerebral Palsy Patients in a Tertiary Hospital in Saudi Arabia: A Retrospective Study

Reem Alyoubi, Ammar Mirza, Fadi Busaleh, Odai W Ashgar, Abdulrahman A Alamoudi, Ahmad M Alnoiqy, Faisal A Alghamdi, Muhnnad A AlGhamdi, Ahlam Mazi, Huda Alyahyawi

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Background Cerebral palsy (CP) is a major cause of childhood motor impairment worldwide. The prevalence of CP related to preterm births has increased consistently. Perinatal hypoxic-ischemic encephalopathy, intra- or periventricular haemorrhage, cerebral dysgenesis and intracranial infections are among the factors contributing to CP onset. Several studies have explored epilepsy-related morbidity among children with CP, finding notable correlations between the two conditions. Worldwide, there are multiple studies highlighting the high prevalence of epilepsy among children with CP and its association with specific CP subtypes and neurologic insults. However, research on the risk factors for epilepsy in CP children is limited, particularly in the Middle East and Saudi Arabia. Aim This study aims to address this gap by analysing potential prenatal, antenatal, and postnatal risk factors associated with epilepsy development in children with CP. Methods A retrospective cohort analysis of 152 children aged 1-14 years diagnosed with CP at King Abdulaziz University Hospital, Jeddah, Saudi Arabia, was conducted. Results The study showed a significant prevalence of epilepsy (68.4%), with generalised seizures being the most common type. Quadriplegia was notably common among CP children with epilepsy, indicating a potential correlation between motor impairment severity and epilepsy risk. Furthermore, CP children with epilepsy exhibited a higher prevalence of co-morbidities, emphasising the multifaceted nature of this condition. Perinatal and neonatal factors, such as hypoxic events, mechanical ventilation, perinatal asphyxia, neonatal convulsions, and microcephaly, were identified as significant risk factors for epilepsy in children with CP. While speech and hearing disorders were present in CP children with and without epilepsy, a slightly higher prevalence of impaired speech was observed in those with epilepsy. However, the difference between the two groups was not significant. Conclusion This study provides valuable insights into the epidemiology, clinical characteristics and potential risk factors associated with epilepsy among children diagnosed with CP in Saudi Arabia. The findings underscore the complexity of managing epilepsy in this population and highlight the need for further research to elucidate the underlying mechanisms and support the development of targeted interventions to improve patient outcomes.

PMID: 38854260

19. The impact of the COVID-19 pandemic on the rehabilitation therapy of children and adolescents with cerebral palsy: a nationwide, health insurance data-based study

Jieun Shin, Mi Jin Hong, Jong Bum Park, Yung Jin Lee

Front Public Health. 2024 May 30:12:1374766. doi: 10.3389/fpubh.2024.1374766. eCollection 2024.

Introduction: The coronavirus disease 2019 (COVID-19) pandemic has profoundly affected the utilization of rehabilitation services. Existing evidence investigating this issue at the nationwide level is lacking, and it is uncertain whether the effects of the COVID-19 pandemic on the use of rehabilitation therapy of children and adolescents with cerebral palsy. This study aimed to investigate the impact of COVID-19 on the rehabilitation therapy of children and adolescents with cerebral palsy. Methods: We obtained data from South Korea's Health Insurance Review and Assessment Agency for 2017-2021. By analyzing the claims data, we focused on rehabilitation therapy in individuals with CP under 18 years of age. We categorized these according to therapy type (physical, occupational, or dysphagia), medical facility, hospital visits, and insurance. We calculated the patient counts and average claims per person and compared the average from before to during the COVID-19 pandemic. Results: Over the 5 years, there was a significant decline in the number of patients undergoing rehabilitation therapy (trend $p = 0.004$), but the average claims per person remained stable (trend $p = 0.971$). During the COVID-19 pandemic, the average number of claims per person decreased significantly compared to the control period ($p = 0.013$). Both the physical ($p = 0.049$) and occupational therapy groups ($p = 0.019$) showed significant differences in claims. General hospitals and hospitals experienced a decrease in average cases by 2.2 ($p < 0.001$) and 2.4 ($p < 0.001$) respectively, while long-term care hospitals increased by 3.1 cases ($p < 0.001$). Outpatients showed a decline of 2.0 cases ($p < 0.001$), whereas inpatients showed an increase of 5.9 cases ($p < 0.001$). Individuals with health insurance decreased by 0.5 cases ($p = 0.007$), but the decrease of 0.08 cases among medical aid-covered individuals was not statistically significant ($p = 0.898$). Conclusion: In 2020-2021, the average number of claims per person showed a significant decrease compared to the pre-COVID-19 pandemic period (2017-2019). Depending on the type of treatment, the number of claims for physical and occupational therapy significantly decreased.

PMID: 38873308

20. Home birth in Croatia - a medico-legal perspective today

Dubravko Habek, Jurica Habek

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In Croatia, the model of obstetrics-midwifery management of childbirth in maternity hospitals is still in effect, and this is how > 99% of Croatian women give birth. However, in my view, midwives are still not sufficiently educated for completely independent work notwithstanding their university education. The Law on Midwifery defined the role of the midwife in home birth without, however, setting out other organisational-communication and professional provisions. Then it began with sporadic midwifery home births of a few per year, which grew quite rapidly, especially with the impact of the Covid-19 virus pandemic, to about 100 out of a total of about 38,000 births that are performed annually in the Republic of Croatia in maternity

hospitals. Since the start of planned home births many bad perinatal outcomes have been recorded in hospital maternity wards who have admitted women after such deliveries. These include puerperal sepsis, protracted labour of several days, neglected protracted labour with perinatal asphyxia and aspiration of meconium amniotic fluid and resuscitation of the newborn (who later developed cerebral palsy), severe postpartum haemorrhage with obstetric shock and postpartum hysterectomy, episiotomy infection, and stillbirth at term pregnancy. Therefore, planned home birth in Croatia should now be regarded as an unsafe birth in extraordinary circumstances and the person who takes charge of it must be professionally prepared, educated and have numerous social skills. Most Croatian gynaecologists and obstetricians give support to midwives in their efforts to be professional and independent when at work, including the controlled and legal implementation of the planned home birth. We unreservedly support self-aware midwives to maintain their profession as highly ethical and professional as possible above the wishes of non-professionals who call for autonomy, so that we do not have to discuss such problems of malpractice of Croatian midwifery in the 21st century.

PMID: 38872239

21. Elevated blood pressure in children with cerebral palsy and its relationship with adiposity and physical activity

Junsoo Lee, Trevor Batson, Kevin K McCully, Ye Shen, Christopher M Modlesky

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Background: There is a high prevalance of hypertension in adults with with cerebral palsy (CP). However, less is known about blood pressure in children with CP. Objective: The aim was to determine if blood pressure is elevated in children with CP and whether it is related to adiposity and physical activity. Methods: Thirty children with spastic CP (5-11 y) and 30 age-, sex-, and race-matched typically developing control children were studied. Resting systolic blood pressure (SBP), diastolic blood pressure (DBP), and heart rate were measured, and mean arterial pressure (MAP) was calculated. Visceral fat mass and total body fat mass index (FMI) were determined using dual-energy X-ray absorptiometry. Physical activity was assessed using accelerometer-based monitors. Results: Children with CP had higher DBP and heart rate than controls ($p < 0.05$). DBP percentile and MAP were also higher in children with CP when BMI was statistically controlled. Children with CP and elevated blood pressure or hypertension ($n = 8$) had 56% more visceral fat mass than children with CP and normal blood pressure ($n = 22$; $p < 0.05$). In the groups combined, blood pressure was directly related to visceral fat mass and FMI, and inversely related to physical activity ($p < 0.05$). However, in children with CP alone, only visceral fat mass was related to blood pressure ($p < 0.05$). Conclusions: Children with CP have higher resting blood pressure than typically developing children. The higher blood pressure is related to higher visceral adiposity. Careful blood pressure screening should start during childhood in individuals with CP.

PMID: 38853095

22. Focal selective dorsal rhizotomy and concurrent deformity correction: a combined approach

Nisha Gadgil, Aloysia L Schwabe, Edward Wright, Amy Barbuto, Eric L Dugan, Sruthi P Thomas, Jeffrey S Shilt, Dorothy Beauvais, Yushane Shih, Brian G Smith, David F Bauer, Daniel J Curry

J Neurosurg Pediatr. 2024 Jun 14:1-8. doi: 10.3171/2024.4.PEDS2432. Online ahead of print.

Objective: Selective dorsal rhizotomy (SDR) is a neurosurgical procedure to reduce spasticity in children with cerebral palsy and spastic diplegia. The authors developed a procedure called focal SDR for children with spasticity predominantly in the L5 or S1 motor distribution, which can be combined with orthopedic correction of fixed soft-tissue or bony deformity. The authors describe in detail the technique of minimally invasive focal SDR and propose selection criteria. Methods: The authors conducted a retrospective study of patients who underwent focal SDR at their institution and underwent baseline and 1-year postoperative 3D gait analysis. Modified Ashworth scale (MAS) and Gait Deviation Index (GDI) scores were the primary outcome measures. Results: Ten patients met the study criteria, all with an underlying diagnosis of cerebral palsy. All underwent focal SDR at the unilateral or bilateral S1 level, and 4 additionally underwent focal SDR at the L5 level unilaterally or bilaterally. All but 1 patient underwent concurrent orthopedic surgery. The improvement in spasticity of the plantar flexors, as measured by the MAS score, was 2.2 ($p < 0.001$). In the patients who underwent L5 focal SDR, there was an improvement in the hamstring MAS score of 1.4 ($p = 0.004$). The mean improvement in the GDI score following focal SDR was 11 (range -6 to 29, $p < 0.001$). Conclusions: Focally impairing spasticity in the gastrocsoleus complex and/or hamstrings muscle group in the setting of less functionally impactful proximal tone is extremely common in cerebral palsy. The novel technique of focal SDR, combined with orthopedic intervention, improves spasticity scores and overall gait mechanics. Further investigation is warranted to define the ideal candidacy and outcomes.

PMID: 38875723

23. Progressive spasticity and developmental delay in an infant with a CTNNB1 mutation

Meagan Freeman, Nina Fakhori, Danielle Monteil

Case Reports BMJ Case Rep. 2024 Jun 13;17(6):e260856. doi: 10.1136/bcr-2024-260856.

We present an infant referred to Developmental Paediatrics for delays, slow growth, hypotonia, esotropia and spasticity. Over the course of 2 months, the infant's exam progressed, demonstrating worsening spasticity and tonal changes in the setting of a normal brain MRI with acquired microcephaly. Genetic testing demonstrated a pathogenic CTNNB1 nonsense mutation. Following the discovery of the underlying cause for the child's clinical picture, the child was evaluated by therapeutic services and neurology, which was initially only available via asynchronous telehealth, due to a resource limited area. Cerebral palsy is a nonprogressive neurodevelopmental disorder and, when associated with developmental delay, qualifies for further genetic investigation into the underlying aetiology. Genetic testing recommendations exist for developmental delay, but there is no current algorithm regarding testing for cerebral palsy. Education and clear guidelines on genetic testing allow for better prognostication and potential treatment in cases of cerebral palsy, especially when associated with other disorders.

PMID: 38871641

24. The psychosocial determinants of adherence to home-based rehabilitation strategies in parents of children with cerebral palsy: A systematic review

Japhet Niyonsenga, Liliane Uwingeneye, Inès Musabyemariya, Jean Baptiste Sagahutu, Francesca Cavallini, Luca Caricati, Rutembesa Eugene, Jean Mutabaruka, Stefan Jansen, Nadia Monacelli

PLoS One. 2024 Jun 12;19(6):e0305432. doi: 10.1371/journal.pone.0305432. eCollection 2024.

Introduction: Involving parents of children with cerebral palsy (C-CP) in home exercise programmes (HEP) is globally practiced strategy closely linked to improved physical performance and functional outcomes for the child. Nevertheless, non-adherence to HEP is increasing at an alarming rate, and little is known about the factors influencing adherence to HEP (AHEP) especially in parents of C-CP. This systematic review aimed to identify the factors enhancing AHEP among parents of C-CP to reinforce the efficacy of rehabilitation practices proposed by health professionals, researchers, and educators. Materials and methods: We conducted searches in PubMed, Scopus, CINHAL, PsycINFO, and Embase for articles published up to March 2023, that investigated the factors influencing AHEP among parents of C-CP. A narrative synthesis was conducted using the search results and pertinent material from other sources. Results: Overall, non-adherence rates to HEP were moderate to high, ranging from 34% to 79.2%. Strong evidence suggests that factors enhancing AHEP fall into three categories: child-related (such as younger age and better gross motor function [GMF]), the caregiver-related (including high self-efficacy and knowledge, strong social support, low levels of depression, anxiety and stress symptoms, and a low perception of barriers), and the physiotherapist-related. For the latter category, the parent's perception of a supportive and collaborative relationship with the therapist is one of the conditions most favourably influences AHEP. Conclusion: Our findings highlight that factors influencing AHEP are multifactorial. Some, such as GMF or the economic and social conditions of the family, are challenging to change. However, the relationship between therapist and parent is an aspect that can be strengthened. These results underscore the importance of substantial training and psychosocial support for therapists to enhance their awareness and competence in building supportive relationship with parents.

PMID: 38865337

25. Simulation based education in paediatric resuscitation

Fenton O'Leary

Review Paediatr Respir Rev. 2024 May 11:S1526-0542(24)00046-0. doi: 10.1016/j.prrv.2024.05.002. Online ahead of print.

There is increasing use of clinical Simulation Based Education (SBE) in healthcare due to an increased focus on patient safety, the call for a new training model not based solely on apprenticeship, a desire for standardised educational opportunities that are available on-demand, and a need to practice and hone skills in a controlled environment. SBE programs should be evaluated against Kirkpatrick level 3 or 4 criteria to ensure they improve patient or staff outcomes in the real world. SBE programs have been shown to improve outcomes in neonatology - reductions in hypoxic ischaemic encephalopathy, in brachial plexus injury, rates of school age cerebral palsy, reductions in 24hr mortality and improvements in first pass intubation rates. In paediatrics SBE programs have shown improvements in paediatric cardiac arrest survival, PICU survival, reduced PICU admissions, reduced PICU length of stay and reduced time to critical operations. SBE can improve the non-technical tasks of teamwork, leadership and communication (within the team and with patients and carers). Simulation is a useful tool in Quality and Safety and is used to identify latent safety issues that can be addressed by future programs. In high stakes assessment simulation can be a mode of assessment, however, care needs to be taken to ensure the tool is validated carefully.

PMID: 38851950

26. Knowledge translation strategies used to promote evidence-based interventions for children with cerebral palsy: a scoping review

Jessica Hanson, Akash Sasitharan, Tatiana Ogourtsova, Annette Majnemer

Review Disabil Rehabil. 2024 Jun 8:1-13. doi: 10.1080/09638288.2024.2360661. Online ahead of print.

Background: Cerebral palsy (CP) is the most common childhood physical disability, imposing substantial costs on individuals and society. Early interventions that promote brain optimization and reorganization are vital for children with CP. Integrating early evidence-based practice (EBP) remains challenging but enhances functional outcomes. Methods: Following a scoping review methodology, databases were searched to identify studies examining the impact of knowledge translation (KT) strategies for pediatric CP interventions. Extraction included study characteristics, methodology, KT strategies, barriers, and facilitators. Numerical and inductive content analysis identified themes among KT strategies. A final stakeholder consultation to discuss the results was conducted. Results: This review included seventeen articles. Common outcomes included participant change in EBP knowledge and behaviour. Common barriers included a need for more resources, protected time, and funding. Most studies followed a multifaceted KT approach. Various KT strategies were used, primarily mentoring, workshops, case studies, and online tools. Interpretation: Results underscored the need for tailored KT strategies for implementing EBP for children with CP. Additionally, user-friendly KT tools and involving mentors to facilitate the intervention can haste EBP uptake. Successful adoption depends on challenges in healthcare settings. This study provides insights into current KT strategies for advancing best practices for children with CP.

PMID: 38850195

27. The Impact of Umbilical Cord Mesenchymal Stem Cells on Motor Function in Children with Cerebral Palsy: Results of a Real-world, Compassionate use Study

Magdalena Chrościńska-Kawczyk, Izabela Zdolińska-Malinowska, Dariusz Boruczkowski

Stem Cell Rev Rep. 2024 Jun 15. doi: 10.1007/s12015-024-10742-2. Online ahead of print.

The aim of this study was to analyze the impact of human umbilical cord-derived MSCs (hUC-MSCs) on motor function in children with cerebral palsy (CP). The study enrolled 152 children with CP who received up to two courses of five hUC-MSCs injections. Children's motor functions were assessed with the Gross Motor Function Measure (GMFM), 6-Minute Walk Test (6 -MWT), Timed Up and Go test (Up&Go test), and Lovett's test, and mental abilities were assessed with the Clinical Global Impression (CGI) scale. Data collected at visit 1 (baseline) and visit 5 (after four injections) were analyzed retrospectively. After four hUC-MSCs administrations, all evaluated parameters improved. The change in GMFM score, by a median of 1.9 points (IQR: 0.0-8.0), correlated with age. This change was observed in all GFMCS groups and was noticed in all assessed GMFM areas. A median increase of 75 m (IQR: 20.0-115.0) was noted on the 6-MWT, and this correlated with GMFM score change. Time on the Up&Go test was reduced by a median of 2 s (IQR: -3 to - 1) and the change correlated with age, GMFM score at baseline, and the difference observed on the 6-MWT. Results of Lovett's test indicated slight changes in muscle strength. According to the CGI, 75.5% (96/151) of children were seriously (level VI) or significantly ill (level V) at the 1st visit, with any improvement observed in 63.6% (96/151) of patients at the 5th visit, 23.8% (36/151) with improvement (level II) or great improvement (level I). In conclusion, the application of hUC-MSCs generally enhanced functional performance, but individual responses varied. The therapy also benefited children with high level of disability but not to the same extent as the initially less disabled children. Although younger patients responded better to the treatment, older children can also benefit. Trial Registration 152/2018/KB/VII and 119/2021/KB/VIII. Retrospective registration in ClinicalTrials: ongoing.

PMID: 38877284