# Cerebral palsy research news

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## Interventions and Management

**1. Hand-Arm Bimanual Intensive Training in Virtual Reality: A Feasibility Study**
James E Gehringer, Elizabeth Fortin, Swati M Surkar, Jie Hao, Monica Pleiss, Sandra Jensen-Willett

Pediatr Phys Ther. 2022 Dec 2. doi: 10.1097/PEP.0000000000000975. Online ahead of print.

Objective: The aim of the study was to evaluate the feasibility of virtual reality (VR) software built using the core concepts of hand-arm bimanual intensive training (HABIT) for improving upper extremity motor function in children with cerebral palsy (CP). Methods: Eight children with CP participated in a 10-day, 40-hour HABIT program. Half of the time custom VR software, HABIT-VR was used. The children's motor skills were assessed pre- and postintervention with the Assisting Hand Assessment, Box and Blocks Test, and Nine-Hole Peg Test. Results: The children had significant and clinically relevant changes in the Assisting Hand Assessment and Box and Blocks Test; however, Nine-Hole Peg Test scores did not change with intervention. Conclusion: These data suggest that combining traditional HABIT strategies with HABIT-VR games improve upper extremity function and gross motor skills but not fine motor skills.

PMID: 36459077

**2. Assessing Dyskinesia in Children with Cerebral Palsy: Moving Forward: A Commentary on Development of a Clinical Framework for the Assessment of Dyskinesia and Function in the Upper Limb in Children with Cerebral Palsy**
Kirsty Stewart

Phys Occup Ther Pediatr. 2022 Nov 27;1-3. doi: 10.1080/01942638.2023.2151295. Online ahead of print.

No abstract available

PMID: 36437504

**3. Postural Control Alterations in Children with Mild Forms of Spastic Cerebral Palsy**
Cemil Özal, Songül Aksoy, Mintaze Kerem Günel

Pediatric Health Med Ther. 2022 Nov 23;13:367-376. doi: 10.2147/PHMT.S378451. eCollection 2022.

Purpose: To determine the postural control responses' differences between children with mild spastic Cerebral Palsy (CP) and children who are typically developing (TD). Patients and methods: Children with spastic CP, Level I-II (n=20, mean age=9.42±4.59 years, 50% girls, 50% boys) and children with TD (N=20, mean age=9.65±3.03, 55% girls, 45% boys) were included in the study. All participants were evaluated with Computerized Dynamic Posturography, Sensory Organization Test (SOT). Results: There were differences between children with spastic CP and children with TD in visual and composite balance score of SOT significantly ($p<0.05$); there were no differences at vestibular and somatosensory scores of SOT. Children with CP had more postural sway than children with TD ($p<0.05$). Conclusion: There were differences between children with mild CP and TD in terms of postural control responses.

PMID: 36447951

**4. Perioperative Care of Children with Severe Neurological Impairment and Neuromuscular Scoliosis- A Practical Pathway to Optimize Peri-Operative Health and Guide Decision Making**
Giuliana C Antolovich, Monica S Cooper, Michael B Johnson, Kris Lundine, Yi Yang, Katherine Frayman, Moya Vandeleur, Ingrid Sutherland, Donna Peachey, Tali Gadish, Ben Turner, Adrienne Harvey

Review J Clin Med. 2022 Nov 16;11(22):6769. doi: 10.3390/jcm11226769.

Neuromuscular scoliosis is a common feature in children with severe neurological impairment (SNI), including those with severe cerebral palsy. Surgical correction of scoliosis is the mainstay of treatment. This group of patients also have associated medical complexity. The complication rates post-surgery are high, although, for many, they are worth the risk. There are currently no published practice guidelines or care pathways for children with SNI who are undergoing scoliosis corrective surgery. In response to the high uptake of this surgery, coupled with the expected complication rates, our hospital established a perioperative clinic. The purpose of this paper is to describe our perioperative approach. This clinic has developed into a service beyond perioperative care and, with the collaborative meeting, enables shared decision-making to identify the right candidate for surgery. The process involves surgical expertise, understanding the family and child at the centre, and optimisation of medical care pre- and post-surgery. In this paper, we describe the process in a step-by-step manner. We provide clinical vignettes, as well as the proformas that we use, and we highlight the benefits of the team-based process.

PMID: 36431246

**5. Follow-up of brace-treated scoliosis in children with cerebral palsy and spina bifida**
Meta N Eek, Annika Blomkvist, Karin Romberg

J Pediatr Rehabil Med. 2022 Nov 23. doi: 10.3233/PRM-210102. Online ahead of print.

Purpose: This study aimed to describe brace use, progression of scoliosis, and surgery in children with cerebral palsy (CP) and spina bifida (SB) who were initially treated with a brace. Methods: Medical records were retrospectively analysed for brace compliance, treatment complications, curve size measurements with and without the brace at both start and at follow-up, and number of patients undergoing spine surgery. Results: Sixty-eight children were included (CP 47, SB 21), 37 of whom were girls, with a mean age at start of treatment of 11.1 (CP) and 8.2 (SB) years. Most had severe motor problems; only four children with CP and five with SB were able to walk. Thirty-five in the group with CP and 11 in the group with SB had a curve size over 40°.Forty used the brace full-time, 19 half-time and nine for a varying proportion of time. Transient complications of brace treatment were seen in 28% . The yearly progression of curve-size was 4.2° in CP and 2.3° in SB.Twenty-eight patients underwent surgery and complications were present in 75% of these patients. Twenty-seven out of 46 patients with severe scoliosis did not undergo surgery. Conclusion: Brace treatment was possible, even in patients with severe scoliosis. Bracing can delay the progression of scoliosis.

PMID: 36442215

**6. Passive Exoskeleton with Gait-Based Knee Joint Support for Individuals with Cerebral Palsy**
Maxwell Kennard, Hideki Kadone, Yukiyo Shimizu, Kenji Suzuki

Sensors (Basel). 2022 Nov 18;22(22):8935. doi: 10.3390/s22228935.

Cerebral palsy is a neurological disorder with a variety of symptoms that can affect muscle coordination and movement. Crouch gait is one such symptom that is defined as excessive knee flexion accompanied by a crouched posture. This paper introduces a passive exoskeleton to support the knee joint during stance of individuals with cerebral palsy that are affected by crouch gait. The exoskeleton utilizes a hydraulic disc brake mechanism that is actuated only by the body weight and gait of the wearer to provide a braking torque at the knee joint. This passive, gait-based control method aims to offer a compact, lightweight, and simple alternative to existing exoskeletons. Preliminary experiments were conducted to verify the mechanics, safety, and braking capabilities of the device with healthy participants. A pilot study with an individual with cerebral palsy was then conducted. The individual with cerebral palsy showed a reduction in hip joint angle when using the device (18.8∘ and 21.7∘ for left and right sides, respectively). The muscle co-activation index was also reduced from 0.48 to 0.24 on the right side and from 0.17 to 0.017 on the left side. However, changes such as activation timing and device training need to be improved to better support the user.

PMID: 36433532

**7. Identification of Functional Cortical Plasticity in Children with Cerebral Palsy Associated to Robotic-Assisted Gait Training: An fNIRS Study**
David Perpetuini, Emanuele Francesco Russo, Daniela Cardone, Roberta Palmieri, Chiara Filippini, Michele Tritto, Federica Pellicano, Grazia Pia De Santis, Rocco Salvatore Calabrò, Arcangelo Merla, Serena Filoni

J Clin Med. 2022 Nov 16;11(22):6790. doi: 10.3390/jcm11226790.

Cerebral palsy (CP) is a non-progressive neurologic condition that causes gait limitations, spasticity, and impaired balance and coordination. Robotic-assisted gait training (RAGT) has become a common rehabilitation tool employed to improve the gait pattern of people with neurological impairments. However, few studies have demonstrated the effectiveness of RAGT in children with CP and its neurological effects through portable neuroimaging techniques, such as functional near-infrared spectroscopy (fNIRS). The aim of the study is to evaluate the neurophysiological processes elicited by RAGT in children with CP through fNIRS, which was acquired during three sessions in one month. The repeated measure ANOVA was applied to the β-values delivered by the General Linear Model (GLM) analysis used for fNIRS data analysis, showing significant differences in the activation of both prefrontal cortex ($F(1.652, 6.606) = 7.638$; $p = 0.022$), and sensorimotor cortex ($F(1.294, 5.175) = 11.92$; $p = 0.014$) during the different RAGT sessions. In addition, a cross-validated Machine Learning (ML) framework was implemented to estimate the gross motor function measure (GMFM-88) from the GLM β-values, obtaining an estimation with a correlation coefficient $r = 0.78$. This approach can be used to tailor clinical treatment to each child, improving the effectiveness of rehabilitation for children with CP.

PMID: 36431267

**8. Psychophysiological Assessment of Children with Cerebral Palsy during Robotic-Assisted Gait Training through Infrared Imaging**
David Perpetuini, Emanuele Francesco Russo, Daniela Cardone, Roberta Palmieri, Chiara Filippini, Michele Tritto, Federica Pellicano, Grazia Pia De Santis, Raffaello Pellegrino, Rocco Salvatore Calabrò, Serena Filoni, Arcangelo Merla

Int J Environ Res Public Health. 2022 Nov 18;19(22):15224. doi: 10.3390/ijerph192215224.

Cerebral palsy (CP) is a non-progressive neurologic pathology representing a leading cause of spasticity and concerning gait impairments in children. Robotic-assisted gait training (RAGT) is widely employed to treat this pathology to improve children's gait pattern. Importantly, the effectiveness of the therapy is strictly related to the engagement of the patient in the rehabilitation process, which depends on his/her psychophysiological state. The aim of the study is to evaluate the psychophysiological condition of children with CP during RAGT through infrared thermography (IRT), which was acquired during three sessions in one month. A repeated measure ANOVA was performed (i.e., mean value, standard deviation, and

sample entropy) extracted from the temperature time course collected over the nose and corrugator, which are known to be indicative of the psychophysiological state of the individual. Concerning the corrugator, significant differences were found for the sample entropy ($F(1.477, 5.907) = 6.888$; $p = 0.033$) and for the mean value ($F(1.425, 5.7) = 5.88$; $p = 0.047$). Regarding the nose tip, the sample entropy showed significant differences ($F(1.134, 4.536) = 11.5$; $p = 0.041$). The findings from this study suggests that this approach can be used to evaluate in a contactless manner the psychophysiological condition of the children with CP during RAGT, allowing to monitor their engagement to the therapy, increasing the benefits of the treatment.

PMID: 36429941

**9. The effect of medial only versus medial and lateral hamstring lengthening on transverse gait parameters in cerebral palsy**

Louis Bezuidenhout, Chris Church, John Henley, Jose J Salazar-Torres, Nancy Lennon, Thomas Shields, Freeman Miller, M Wade Shrader

J Pediatr Orthop B. 2023 Jan 1;32(1):80-86. doi: 10.1097/BPB.0000000000001017.

Benefits of hamstring lengthening surgery on the sagittal plane in children with cerebral palsy have been previously demonstrated, but there is limited information on its effects on the transverse plane. This study compared the effects of medial hamstring lengthening (MHL) with those of medial and lateral hamstring lengthening (MLHL) procedures in the transverse plane. Children with gross motor function classification system (GMFCS) levels I-III who had MHL or MLHL were included. Baseline, short- (1-2 years), and long-term (3+ years) postoperative three-dimensional gait analysis outcomes were compared using analysis of variance. Children were excluded if they had concurrent osteotomies or tendon transfers. One hundred fifty children (235 limbs) were included, with 110 limbs in the MHL group (age 8.5 ± 4.1 years, GMFCS I-27%, II-52%, and III-21%) and 125 limbs in the MLHL group (age 10.0 ± 4.0 years, GMFCS I-23%, II-41%, and III-37%). Time between surgery and short- and long-term follow-up gait analysis was 1.5 ± 0.6 years and 6.6 ± 2.9 years, respectively. Transmalleolar axis became more external after MHL at both short and long terms ( $P < 0.05$), whereas there were only significant differences at long term in MLHL ( $P < 0.05$). Although hamstring lengthening has a positive impact on stance phase knee extension in children with cerebral palsy, intact lateral hamstrings after MHL likely contribute to increased tibial external rotation after surgery. Significant increases in external rotation at the knee in the long term are likely related to a trend present with growth in children with cerebral palsy rather than a direct result of surgical intervention.

PMID: 36445368

**10. Evaluation of a technique of patellar tendon shortening to correct patella alta associated with severe crouch gait in cerebral palsy**

Vipin Mohan, Dhiren Ganjwala, Kumar Singh, Hitesh Shah

J Pediatr Orthop B. 2023 Jan 1;32(1):87-93. doi: 10.1097/BPB.0000000000000973.

This study was undertaken to evaluate the results of patella tendon shortening to correct patella alta in the context of surgery for the management of severe crouch gait. Our aim was to ascertain whether the corrected position of the patella and improvement of the power of the quadriceps were maintained for 4 years or more. Twenty older children (mean age: 14.2 years) with long-standing crouch gait secondary to cerebral diplegia underwent surgery to correct crouch gait that included the patellar tendon shortening. The technique for plicating the tendon differed for skeletally mature and immature patients. The length of the patellar tendon was measured by the Koshino Index. The strength of the quadriceps muscle was assessed by manual muscle testing and with a dynamometer and extensor lag, if present, was measured with a goniometer. In all 40 knees, the patella was brought to a more distal position and the position was maintained for a mean duration of 84 months (Koshino Index: preoperative 1.3 ± 0.10; 3-month postoperative 0.95 ± 0.05; final follow-up 0.95 ± 0.04). The results were the same for the techniques used for skeletally mature and immature patients. The power of the quadriceps improved [Medical Research Council (MRC) grade 3 to MRC grade 4] and the improvement was maintained. The technique of patella tendon shortening was effective in correcting patella alta and improving quadriceps power. The shortened patellar tendon did not stretch over the period of follow-up. Level of evidence: III.

PMID: 36445353

**11. The Effects of Prolonged Vibrotactile EMG-Based Biofeedback on Ankle Joint Range of Motion During Gait in Children with Spastic Cerebral Palsy: A Case Series**
Matteo Bertucco, Mauro Nardon, Nicole Mueske, Sukhveer Sandhu, Susan A Rethlefsen, Tishya A L Wren, Terence D Sanger

Phys Occup Ther Pediatr. 2022 Nov 29;1-16. doi: 10.1080/01942638.2022.2151391. Online ahead of print.

Aims: The objective of this case series was to examine the feasibility of vibrotactile EMG-based biofeedback (BF) as a home-based intervention tool to enhance sensory information during everyday motor activities and to explore its effectiveness to induce changes in active ankle range of motion during gait in children with spastic cerebral palsy (CP). Methods: Ten children ages 6 to 13 years with spastic CP were recruited. Participants wore two EMG-based vibro-tactile BF devices for at least 4 hours per day for 1-month on the ankle and knee joints muscles. The device computed the amplitude of the EMG signal of the target muscle and actuated a silent vibration motor proportional to the magnitude of the EMG. Results: Our results demonstrated the feasibility of the augmented sensory information of muscle activity to induce changes of the active ankle range of motion during gait for 6 children with an increase ranging from 8.9 to 51.6% compared to a one-month period without treatment. Conclusions: Preliminary findings of this case series demonstrate the feasibility of vibrotactile EMG-based BF and suggest potential effectiveness to increase active ankle range of motion, therefore serving as a promising therapeutic tool to improve gait in children with spastic CP.

PMID: 36446743

**12. Running capacity in children with bilateral cerebral palsy: What are the biomechanical and neuromotor differences between runners and walkers?**
Annie Pouliot-Laforte, Anne Tabard-Fougère, Alice Bonnefoy-Mazure, Geraldo De Coulon, Stéphane Armand

Clin Biomech (Bristol, Avon). 2022 Nov 11;100:105817. doi: 10.1016/j.clinbiomech.2022.105817. Online ahead of print.

Background: Running is a high-level locomotor activity requiring more from joints, muscles and a more complex interaction of the neuromuscular system than walking. High-level locomotor activity has the potential to shed light on motor function deficits that lower-level activity does not reveal. Therefore, the study aimed to compare biomechanical and neuromotor function between a group of children with bilateral cerebral palsy who are able and unable to run. Methods: Retrospectively, children with bilateral cerebral palsy aged between 6 and 18 years who completed a clinical gait analysis between 2006 and 2019 were included. Participants were categorized as walkers or runners based on the presence of a double floating phase. Spasticity, selectivity, muscle weakness, and passive range of motion of the lower limbs were measured and dichotomized as «normal» or «abnormal» based on reference values. Functional tasks reflecting balance (standing on one leg) and power (single leg and two-legged jumps) were realized and evaluated as failure or success. Findings: 75 children with bilateral cerebral palsy (53 runners/22 walkers) were included. Children classified as runners were stronger (hip flexors, $p = 0.006$; hip abductors, $p = 0.022$; knee flexors, $p = 0.001$; dorsiflexors, $p = 0.014$), had greater selectivity (hip flexors, $p = 0.011$; dorsiflexors, $p = 0.001$; plantiflexors, $p = 0.043$) and lower spasticity at the knee extensors ($p = 0.045$). No differences were observed in the passive range of motion between the two groups. Children classified as runners performed better at all tasks of balance and power ($p < 0.05$). Interpretation: Flexors muscles strength and selectivity and knee extensor spasticity are key points for running ability in children with bilateral cerebral palsy.

PMID: 36435078

**13. Review of Sensory Integration Therapy for Children With Cerebral Palsy**
Vaishnavi B Warutkar, Rakesh Krishna Kovela

Review Cureus. 2022 Oct 26;14(10):e30714. doi: 10.7759/cureus.30714. eCollection 2022 Oct.

Cerebral palsy (CP) refers to a group of non-progressive brain disorders. Several different approaches are used to treat cerebral palsy children like neurodevelopmental therapy (NDT), sensory integration therapy (SIT), and hippotherapy. Sensory integration therapy is a clinically based approach that places an emphasis on the relationship between the therapist and the child and uses play-based sensory and motor activities to encourage analysis and integration. SIT seems to offer a lot of therapeutic

prospects. It uses various interventions. According to sensory integration therapists, some impacts of SIT include an improved ability to concentrate in academic, therapeutic, and social settings. Sensory integration treatment is successful in enhancing gait, balance, and gross motor function.

PMID: 36439588

**14. Facilitators and barriers to participation in physical activities in children and adolescents living with cerebral palsy: a scoping review**
Manel Abid, Yosra Cherni, Charles Sèbiyo Batcho, Elodie Traverse, Marie Denise Lavoie, Catherine Mercier

Disabil Rehabil. 2022 Nov 29;1-16. doi: 10.1080/09638288.2022.2150327. Online ahead of print.

Purpose: This scoping review aimed to synthetize personal and environmental facilitators and barriers to participation in physical activities among youths living with cerebral palsy. Methods: A systematic literature search was performed in five databases: CINAHL, EMBASE, MEDLINE, PsycINFO, Cochrane, WEB OF SCIENCE. The studies were selected by two independent researchers based on inclusion and exclusion criteria. A semi-quantitative evaluation assessed the consistency of results for a given variable. Variables displaying consistent associations were classified based on the Physical Activity for people with Disability Model. Results: The electronic search yielded 10 795 articles, of which 57 were included. The main barriers to physical activity identified were motor impairments (30 studies), older age (15 studies), pain (6 studies), attendance in regular school (6 studies), and communication problems (4 studies). Barriers such as upper limb impairment and visual deficit were less frequently studied, while cognitive attributes, adapted physical environments and positive attitude, and family support were identified as facilitators. Conclusion: Personal and environmental factors influencing physical activities behaviors among youths living with cerebral palsy are multiple and complex since they interact with each other. Rehabilitation interventions need to adopt a person-based approach to address barriers and reinforce facilitators. IMPLICATIONS FOR REHABILITATION: Physical activity participation among youths with cerebral palsy is a multidimensional phenomenon, dependent on different personal and environmental factors. Gross motor impairments, communication problems, and pain were the most common personal factors limiting physical activity participation. Environmental factors consistently associated with physical activity participation were school settings, physical environment such as transportation, and social and family support and attitude. Rehabilitation interventions to promote an active lifestyle should consider not only personal factors but their interaction with the child's environment.

PMID: 36447398

**15. Does exercise affect quality of life and participation of adolescents and adults with cerebral palsy: a systematic review**
James Czencz, Nora Shields, Margaret Wallen, Peter H Wilson, Thomas B McGuckian, Christine Imms

Disabil Rehabil. 2022 Dec 2;1-17. doi: 10.1080/09638288.2022.2148297. Online ahead of print.

Purpose: Investigate the effect of exercise for adults with cerebral palsy (CP) on quality of life, participation (attendance and involvement in life situations), functional mobility, pain, fatigue, mood, and self-efficacy. Methods: A systematic review was completed. Twelve databases were searched from inception to August 2022 for studies including participants (≥16 years) with cerebral palsy, and that evaluated an exercise intervention. Two reviewers independently assessed eligibility, risk of bias, and extracted data. Results: Seventeen studies (total n = 532) were included: 12 randomised control trials, four non-randomised trials, and one single case experimental design. Interventions studied were predominantly strength, aerobic or treadmill training, dance, and swimming. No study assessed participation, pain or mood. Of two studies that assessed quality of life, one reported a positive effect on an aspect of mental health immediately after the programme finished. All studies assessed functional mobility, but only one reported a positive effect. One study assessed self-efficacy and found no effect, and another assessed fatigue and reported conflicting results. Conclusions: The effect of exercise for adults with CP, on outcomes that adults report as important to them - quality of life, participation, pain, mood, and fatigue - are unknown. IMPLICATIONS FOR REHABILITATION: To address outcomes important to adults with cerebral palsy (CP), it is important to understand how exercise affects participation and quality of life. All modes of exercise reviewed appear safe for adults with CP and choice should be based on the client's preferences, access to services, and convenience. Addressing any needed accommodations in the environment and context is likely more important than exercise prescription parameters when tailoring exercise to meet the needs of adults with CP and sustain participation.

PMID: 36458738

**16. [Mirror and action observation therapy in children with unilateral spastic cerebral palsy: a feasibility study][Article in Spanish]**
R Palomo-Carrión, J C Zuil-Escobar, M Cabrera-Guerra, P Barreda-Martínez, C B Martínez-Cepa

Randomized Controlled Trial Rev Neurol. 2022 Dec 1;75(11):325-332. doi: 10.33588/rn.7511.2022343.

Introduction: Unilateral spastic cerebral palsy affects upper extremity function. Mirror and home-based action observation therapies may be useful in its treatment. The aim has been to evaluate the feasibility of action observation therapy and mirror therapy programmes combined with home action observation in children with unilateral spastic cerebral palsy. Subjects and methods: The feasibility study included children (6-12 years old), randomly assigned to two groups: action observation therapy and mirror therapy and action observation. Twenty-hour home sessions were conducted, including unimanual and bimanual activities. Feasibility of interventions and procedures, and spontaneous use (Assisting Hand Assessment scale) and functionality (Jebsen Taylor Hand Function Test) of the upper extremity were assessed. Results: Twenty-five families were recruited, with 17 meeting the inclusion criteria. Twelve children (8.75 ± 2.38 years) participated in the study. All families completed the interventions, with no adverse effects. The total intervention dose was above 96%. After the intervention, clinically relevant changes were found in both groups in spontaneous use of the upper extremity, as well as in functionality in the action observation therapy group. Conclusions: Action observation therapy and mirror therapy combined with action observation therapy are considered feasible to be applied at home and aimed at children with unilateral spastic cerebral palsy.

PMID: 36440744

**17. Cerebral visual impairment in children: Multicentric study determining the causes, associated neurological and ocular findings, and risk factors for severe vision impairment**
Monalisa Mohapatra, Soveeta Rath, Pradeep Agarwal, Abhishek Singh, Rupali Singh, Sameer Sutar, Anupam Sahu, Veenu Maan, Suma Ganesh

Multicenter Study Indian J Ophthalmol. 2022 Dec;70(12):4410-4415. doi: 10.4103/ijo.IJO_801_22.

Purpose: To evaluate the causes, associated neurological and ocular findings in children with cerebral visual impairment (CVI), and to identify risk factors for severe vision impairment. Methods: A multicenter, retrospective, cross-sectional analysis was carried out from January 2017 to December 2019 on patients less than 16 years of age with a diagnosis of CVI. Results: A total of 405 patients were included of which 61.2% were male and 38.8% were female. The median age at presentation was 4 years (range 3 months to 16 years). Antenatal risk factors were present in 14% of the cases. The most common cause of CVI was hypoxic-ischemic encephalopathy (35.1%), followed by seizure associated with brain damage (31.3%). The most common neurological finding was seizure (50.4%), followed by cerebral palsy (13.6%). Associated ophthalmological findings were significant refractive error (63.2%), esotropia (22.2%), exotropia, (38%), nystagmus (33.3%), and optic nerve atrophy (25.9%). Severe visual impairment (<20/200) was associated with optic atrophy (odds ratio: 2.9, 95% confidence interval: 1.4-6.0; P = 0.003) and seizure disorder (odds ratio: 1.9, 95% confidence interval: 1.2-3.3; P = 0.012). Conclusion: The various ophthalmic, neurological manifestations and etiologies could guide the multidisciplinary team treating the child with CVI in understanding the visual impairment that affects the neuro development of the child and in planning rehabilitation strategies.

PMID: 36453355

**18. Correlations between gastrointestinal and oral microbiota in children with cerebral palsy and epilepsy**
Congfu Huang, Chunuo Chu, Yuanping Peng, Nong Zhang, Zhenyu Yang, Jia You, Fengxiang Wei

Front Pediatr. 2022 Nov 4;10:988601. doi: 10.3389/fped.2022.988601. eCollection 2022.

We here studied the correlation between gut and oral microbiota in children with cerebral palsy and Epilepsy (CPE). We enrolled 27 children with this condition from the social welfare center of Longgang District, collected their oral plaque and stool samples, and analyzed their gut microbiota (GM) and oral microbiota (OM) through 16S rRNA gene sequencing. Taxonomical annotation revealed that the levels of Firmicutes and Bacteroides in the oral cavity were significantly lower in CPE children than in healthy children, whereas the abundance of Actinomycetes increased significantly in CPE children. In addition, Prevotella, Fusobacterium, and Neisseria were the top three abundant genera, representing 15.49%, 9.34%, and 7.68%

of the OM and suggesting potential correlations with caries, periodontitis, and malnutrition. For the GM, Bifidobacterium, Bacteroides, and Prevotella were the top three abundant genera in CPE children and probably contributed to the development of chronic inflammation and malnutrition. Furthermore, the OM and GM correlated with each other closely, and the bacterial components of these microbiota in CPE children were remarkably different from those in healthy children, such as Bifidobacterium, Fusobacterium, Bacteroides, and Neisseria. Conclusively, dysbiotic OM can translocate to the intestinal tract and induce GM dysbiosis, suggesting the consistency between OM and GM variations. Altered oral and gut microbial structures have potential impacts on the occurrence of clinical diseases such as periodontitis, caries, and malnutrition.

PMID: 36440329

**19. Special Care Patients and Caries Prevalence in Permanent Dentition: A Systematic Review**
Miguel Ramón Pecci-Lloret, María Pilar Pecci-Lloret, Francisco Javier Rodríguez-Lozano

Review Int J Environ Res Public Health . 2022 Nov 17;19(22):15194. doi: 10.3390/ijerph192215194.

Due to the increase in the population with special needs and the significant difficulty in their dental management, it is essential to analyze the caries prevalence in this group of patients. The systematic review was conducted following the PRISMA statement. A search was performed on 9 May 2022 and updated on 5 June 2022, in three databases: Pubmed, Scielo, and Cochrane library. Studies involving the analysis of caries in permanent teeth in patients with special needs were included. A total of 1277 studies were analyzed and 21 studies were selected. Quality assessments were performed using an adapted version of the STROBE guidelines. Among the analyzed groups (intellectual disabilities, human immunodeficiency virus infection, schizophrenia, down syndrome, drug addicts, adult heart transplant, kidney disease, diabetic, autism, psychiatric patients, cerebral palsy, and hemophilia), the highest prevalence of caries was observed in patients with intellectual disability, without differences between genders. However, there is a need for more studies with standardized methods for caries diagnosis to further investigate the prevalence of caries in permanent teeth in patients with special needs.

PMID: 36429911

**20. Implementing the language comprehension test C-BiLLT: a qualitative description study using the COM-B model of behaviour change**
J N Bootsma, M Phoenix, J J M Geytenbeek, K Stadskleiv, J W Gorter, S Fiske, B J Cunningham

BMC Health Serv Res. 2022 Nov 28;22(1):1421. doi: 10.1186/s12913-022-08803-8.

Background: It is challenging to reliably assess the language comprehension of children with severe motor and speech impairments using traditional assessment tools. The Computer Based instrument for Low motor Language Testing (C-BiLLT) aims to reduce barriers to evidence-based assessment for this population by allowing children to access the test using non-traditional methods such as eye gaze so they can independently respond to test items. The purpose of this study is to develop a contextualized understanding of the factors that influenced clinicians' implementation of the C-BILLT in practice in the Netherlands and Norway. Materials and methods: A qualitative approach including semi-structured individual interviews with 15 clinicians (speech-language pathologists, neuropsychologists, and one teacher, counsellor, and vision specialist) was used. Data analysis was conducted in two rounds. First, a deductive approach including a codebook was used to code data within the COM-B components describing clinicians' capability, opportunity, and motivation for behaviour change. Then, an abductive approach applying thematic analysis was used to identify meaningful patterns within the COM-B components. Results: Several meaningful barriers and facilitators were identified across the data. Clinicians used the C-BiLLT with two distinct groups of clients: (1) the population it was originally developed for, and (2) clients that could have also been assessed using a traditional language test. Clinicians working with the first group experienced more, and more complex barriers across all COM-B components, to successful C-BiLLT use than the latter. Conclusion: This study provides timely insights into the capability, opportunity, and motivation factors important for creating and sustaining assessment behaviour change in clinicians who used or attempted to use the C-BiLLT. Potential tailored intervention strategies aimed at improving implementation of novel assessment tools are discussed and may be helpful for others working to improve service delivery for children with complex needs.

PMID: 36443759

**21. Does exercise affect quality of life and participation of adolescents and adults with cerebral palsy: a systematic review**
James Czencz, Nora Shields, Margaret Wallen, Peter H Wilson, Thomas B McGuckian, Christine Imms

Disabil Rehabil. 2022 Dec 2;1-17. doi: 10.1080/09638288.2022.2148297. Online ahead of print.

Purpose: Investigate the effect of exercise for adults with cerebral palsy (CP) on quality of life, participation (attendance and involvement in life situations), functional mobility, pain, fatigue, mood, and self-efficacy. Methods: A systematic review was completed. Twelve databases were searched from inception to August 2022 for studies including participants (≥16 years) with cerebral palsy, and that evaluated an exercise intervention. Two reviewers independently assessed eligibility, risk of bias, and extracted data. Results: Seventeen studies (total n = 532) were included: 12 randomised control trials, four non-randomised trials, and one single case experimental design. Interventions studied were predominantly strength, aerobic or treadmill training, dance, and swimming. No study assessed participation, pain or mood. Of two studies that assessed quality of life, one reported a positive effect on an aspect of mental health immediately after the programme finished. All studies assessed functional mobility, but only one reported a positive effect. One study assessed self-efficacy and found no effect, and another assessed fatigue and reported conflicting results. Conclusions: The effect of exercise for adults with CP, on outcomes that adults report as important to them - quality of life, participation, pain, mood, and fatigue - are unknown. IMPLICATIONS FOR REHABILITATION: To address outcomes important to adults with cerebral palsy (CP), it is important to understand how exercise affects participation and quality of life. All modes of exercise reviewed appear safe for adults with CP and choice should be based on the client's preferences, access to services, and convenience. Addressing any needed accommodations in the environment and context is likely more important than exercise prescription parameters when tailoring exercise to meet the needs of adults with CP and sustain participation.

PMID: 36458738

**22. Long-term outcomes of preterm infants in the first 6 years of life: a nationwide population-based study in Korea**
Ju Hyun Jin, Sung Hee Lee, Tae Mi Youk, Shin Won Yoon

Eur J Pediatr. 2022 Nov 29. doi: 10.1007/s00431-022-04728-w. Online ahead of print.

This study examined the relationship between gestational age and long-term outcomes up to 6 years of age using population-based big data from the National Health Insurance Service in Korea. This retrospective observational cohort study used data from the National Health Information Database (2011-2017). All children born in Korea during 2011 (January 1-December 31) were eligible and were followed up until 2017. Gestational age groups were divided into extremely preterm (< 28 weeks), very preterm (28-31 weeks), moderate-to-late preterm (32-36 weeks), and full-term (37-41 weeks). The survival rate, neurodevelopmental diseases, hearing or visual impairment, and respiratory morbidities were compared for each gestational age group. In total, 370,301 children were included in the analysis. The total survival rate increased with increasing gestational age. Furthermore, the risk of neurodevelopmental diseases (i.e., epilepsy, cerebral palsy, delayed development, mental retardation, language disorder, developmental coordination disorder, autism spectrum disorder), hearing or visual impairment, and asthma-related inhaler prescription increased with decreasing gestational age, despite adjustment for covariates. Conclusion: Lower gestational age was associated with an increase in a wide spectrum of adverse neurodevelopmental and respiratory outcomes in the first 6 years of life. Although morbidities were highest at the earliest gestational ages, moderate-to-late preterm children were significantly associated with increased adverse outcomes compared with full-term children. Our findings prove this under-recognized group's long-term follow-up and policy support. What is known: • Infants born preterm are at high risk for neurodevelopmental and various medical health problems. • Nationwide research on long-term outcomes for moderate-to-late preterm birth is sparse. What is new: • In this nationwide cohort study, lower gestational age at birth was inversely associated with increased adverse neurodevelopmental and respiratory outcomes in the first 6 years of life. • Long-term follow-up and policy support are required for moderate-to-late preterm children who are at risk of increased adverse outcomes compared with full-term births.

PMID: 36445516

**23. Fetal heart rate patterns complicated by chorioamnionitis and subsequent cerebral palsy in Japan**
Tomoko Yamaguchi-Goto, Masanao Ohashi, Yuki Kodama, Hiroshi Sameshima

J Obstet Gynaecol Res. 2022 Nov 25. doi: 10.1111/jog.15508. Online ahead of print.

Aim: This retrospective study was performed to investigate whether certain fetal heart rate patterns were associated with subsequent cerebral palsy (CP) in infants with chorioamnionitis at or near term. Methods: We used cases registered by the Japan Obstetric Compensation System for CP, which is a nationwide population-based database. Among them, 133 infants with chorioamnionitis who were born at ≥34 weeks of gestation were enrolled. All infants underwent magnetic resonance imaging (MRI), and all fetal heart rate charts had been interpreted according to the National Institute of Child Health and Human Development criteria, focusing on antepartum and immediately before delivery. Results: The incidence of CP after chorioamnionitis at ≥34 weeks of gestation was 0.3 per 10 000 in Japan. Between the clinical (24%) and subclinical groups (76%), the incidence of abnormal fetal heart rate patterns did not differ. According to the MRI classification, 88% of the infants with CP showed hypoxic-ischemic encephalopathy. Half of the infants with CP experienced terminal bradycardia, leading to severe acidosis and exclusively to hypoxic-ischemic encephalopathy. In another half, who did not experience bradycardia, 80% had moderate acidosis (pH 7.00-7.20) resulting in hypoxic-ischemic encephalopathy, and the remaining 20% showed non-acidosis resulting in brain damage other than hypoxic-ischemic encephalopathy. The fetal heart rate patterns before the terminal bradycardia showed that the incidence rates of late deceleration or decreased variability were high (>60%). Conclusion: Fifty percent of pregnant women with chorioamnionitis-related CP had terminal bradycardia that exclusively resulted in hypoxic-ischemic encephalopathy.

PMID: 36433630

**24. Fracture Rates in Children with Cerebral Palsy: A Danish, Nationwide Register-Based Study**
Jakob Bie Granild-Jensen, Alma Becic Pedersen, Eskild Bendix Kristiansen, Bente Langdahl, Bjarne Møller-Madsen, Charlotte Søndergaard, Stense Farholt, Esben Thyssen Vestergaard, Gija Rackauskaite

Background: In children with cerebral palsy (CP), fracture rates have been reported to be higher than in the general population but age-specific fracture rates have not been directly compared and the effect of comorbid epilepsy needs elucidation. This impairs decision-making regarding bone health interventions. Aim: We aimed to establish the age-specific fracture rates in children with CP with and without epilepsy in Denmark. Materials and methods: Data from Danish registers were combined to establish cohorts of children with and without CP born in Denmark from 1997 to 2007. Fracture rates were calculated for 1997-2016. Results: We identified 1,451 children with CP and 787,159 without CP. Female/male fracture rates per 1,000 person-years were 23/27 with CP and 23/29 without CP. Male sex, epilepsy and anti-seizure medication, but not the diagnosis of CP or GMFCS-level, were associated with higher fracture rates. Relatively more lower extremity fractures occurred in non-ambulant children with CP. Interpretation/conclusion: We found no increased fracture rates in children with CP when compared to peers; however, fracture locations suggested bone fragility in non-ambulant children. All children with epilepsy and on anti-seizure medication had increased fracture rates. We suggest bone health optimization in these groups.

PMID: 36444291

**25. Exploring the quality of life of adolescents with Cerebral Palsy participating in conductive education around the Pannonian Basin**
Dóra Mladoneczki-Leszkó, Rebeka Surányi, Anna Kelemen

PLoS One. 2022 Dec 1;17(12):e0277543. doi: 10.1371/journal.pone.0277543. eCollection 2022.

Introduction: Quality of life (QoL) is a concept that includes physical, psychological, social, spiritual, and other domains of functioning. Good QoL is a fundamental goal of treatment for Cerebral Palsy (CP), therefore it is an outstanding goal of Conductive Education (CE) as well. CE is a Hungarian method that combines special education and rehabilitation for people living with CP. Objective: We aimed to compare the opinions and views about the life of teenagers from the perspective of adolescents and their caregivers from different socio-cultural backgrounds. Method: It was a descriptive, cross-sectional study. We used the Cerebral Palsy Quality of Life for the adolescent questionnaire (CP QoL -Teen) to measure QoL, which was translated into Hungarian and validated by Semmelweis University in 2017. Our study included 20 young adolescents (mean age 16) with CP and their caregivers living in Hungary (n1 = 40) and 20 Hungarian-speaking families (n2 = 40) from

surrounding countries: Slovakia, Romania, and Ukraine (mean age 14.5). All the families are participating in CE. Results: There was no significant divergence in the whole QoL score between the groups. Nonetheless, we found an outstanding difference in the Hungarian groups' 'Feelings about functioning' domain between teens and caregivers. A significant proportion of Hungarian teens-although living with greater pain-are less concerned about their illness (R = -0.754). 85% of responders study at segregated schools offering CE. Conclusion: The study shed new light on the importance of a personalized form of education and on the weight of the positive effects of segregated education. Personalized education can develop the patients' QoL.

PMID: 36454802

**26. Serious health-related suffering experienced by children with disability and their families living in Bangladesh: A scoping review**
Suzanne E Smith, Mostofa Kamal Chowdhury, Megan Doherty, Deidre D Morgan

Palliat Med. 2022 Nov 25;2692163221136896. doi: 10.1177/02692163221136896. Online ahead of print.

Background: In 2020, the International Association for Hospice and Palliative Care redefined palliative care to incorporate the concept of serious health-related suffering. An estimated 21 million children globally live with conditions which would benefit from a palliative approach to relieve suffering. Bangladesh is a lower-middle income country with isolated provision of palliative care. Aim: To synthesise existing evidence describing serious health-related suffering of children with disability and their families living in Bangladesh and the intersection between this suffering, palliative care and rehabilitation. Design: Scoping review methodology. Data sources: A search strategy related to serious health-related suffering and childhood disability was applied to online databases and grey literature. English language studies (1990-2021) were included. Papers pertaining to serious health-related suffering of typically developing children and those over eighteen years were excluded. Data which addressed the three domains of serious health-related suffering (physical, social and emotional/spiritual) were extracted. Palliative care interventions were assessed with a pre-existing checklist. Results: Forty-six studies were included, representing ten different methodologies. Sample sizes ranged from 11 to 2582 participants, with 87% of studies including children with cerebral palsy. Serious health-related suffering was described in 100% of the studies, only 14 of the studies described specific interventions to mitigate suffering. Convergence between palliative care and rehabilitation approaches was evident. Conclusion: Findings document the extensive nature and burden of serious childhood health-related suffering that may be remediated by a palliative approach. They highlight the urgent need to prioritise service development and research in this area.

PMID: 36428280

**27. Changes in UK paediatric long-term ventilation practice over 10 years**
Nicki Barker, Aditi Sinha, Catherine Jesson, Tahera Doctor, Omendra Narayan, Heather E Elphick

Arch Dis Child. 2022 Nov 29;archdischild-2021-323562. doi: 10.1136/archdischild-2021-323562. Online ahead of print.

Objectives: To provide up-to-date information on the use of long-term ventilation (LTV) in the UK paediatric population and to compare the results with data collected 10 and 20 years previously. Design: A single timepoint census completed by LTV centres in the UK, carried out via an online survey. Setting and patients: All patients attending paediatric LTV services in the UK. Results: Data were collected from 25 LTV centres in the UK. The total study population was 2383 children and young people, representing a 2.5-fold increase in the last 10 years. The median age was 9 years (range 0-20 years). Notable changes since 2008 were an increase in the proportion of children with central hypoventilation syndrome using mask ventilation, an increase in overall numbers of children with spinal muscular atrophy (SMA) type 1, chronic lung disease of prematurity and cerebral palsy being ventilated, and a 4.2-fold increase in children using LTV for airway obstruction. The use of 24-hour ventilation, negative pressure ventilation and tracheostomy as an interface had declined. 115 children had received a disease-modifying drug. The use of ataluren and Myozyme did not influence the decision to treat with LTV, but in 35% of the children with SMA type 1 treated with nusinersin, the clinician stated that the use of this drug had or may have influenced their decision to initiate LTV. Conclusion: The results support the need for national database for children and young people using LTV at home to inform future recommendations and assist in resource allocation planning.

PMID: 36446480

**28. Cerebral Palsy and Maternal Injury During Pregnancy**
Zeyan Liew, Haoran Zhuo

JAMA Pediatr. 2022 Nov 28. doi: 10.1001/jamapediatrics.2022.4541. Online ahead of print.

No abstract available

PMID: 36441524

**29. In Utero Exposure to Maternal Injury and the Associated Risk of Cerebral Palsy**
Asma Ahmed, Laura C Rosella, Maryam Oskoui, Tristan Watson, Seungmi Yang

JAMA Pediatr. 2022 Nov 28. doi: 10.1001/jamapediatrics.2022.4535. Online ahead of print.

Importance: Although maternal unintentional injury during pregnancy has shown negative impacts on the mother and fetus, the evidence on its long-term associations with children's neurodevelopment is limited. Objective: To examine the association between maternal unintentional injury and cerebral palsy (CP) in offspring. Design, setting, and participants: This was a population-based, longitudinal, cohort study of all in-hospital live births born between April 1, 2002, and March 31, 2017, in a publicly funded health care system setting of Ontario, Canada. Infants born more than 20 weeks' gestation were included and followed up until March 31, 2018. Excluded from the analysis were stillbirths, infants with missing or invalid records, and births with missing or invalid birth characteristics. Data were analyzed from March 1 to June 30, 2021. Exposures: Maternal unintentional injury during pregnancy ascertained based on inpatient or emergency department diagnoses. Main outcomes and measures: CP diagnosis between birth and the end of follow-up in 2018 with the CP case definition of a single inpatient or 2 or more outpatient diagnoses at least 2 weeks apart between birth and age 16 years. Results: Of 2 110 177 children included in this study (mean [SD] gestational age, 38.8 [1.9] weeks; 1 082 520 male [51.3%]), 81 281 (3.9%) were exposed in utero to maternal unintentional injury. During a median (IQR) follow-up time of 8 (4-12) years, 5317 children (0.3%) were diagnosed with CP (292 CP cases [5.5%] were exposed to maternal unintentional injury). The mean incidence rates of CP were 4.36 and 2.93 per 10 000 child-years in the exposed and the unexposed group, respectively. Children exposed to maternal unintentional injury had a modest increase in the risk of CP, compared with those unexposed (hazard ratio [HR], 1.33; 95% CI, 1.18-1.50) after adjusting for maternal sociodemographic and clinical characteristics. Severe injuries that resulted in hospitalization and delivery within 1 week from the injury conferred higher risks of CP (adjusted HR, 2.18; 95% CI, 1.29-3.68 and adjusted HR, 3.40; 95% CI, 1.93-6.00, respectively). Results were robust in multiple bias analyses. Conclusions and relevance: In this Canadian population-based birth cohort study, in utero exposure to maternal unintentional injury was associated with an increased risk of CP, with a higher risk with more severe injuries. These findings fill an important gap in knowledge on the potential role of maternal injury on children's neurodevelopment outcomes. Public health professionals and stakeholders should be aware of these potential long-term consequences on offspring when designing programs and providing recommendations about safety during pregnancy. Early monitoring and developmental assessment of children exposed to maternal injury might be warranted.

PMID: 36441546

**30. Childhood Neurologic Conditions: Movement Disorders**
Paul Youssef

FP Essent. 2022 Dec;523:20-26.

Most movement disorders in children are hyperkinetic. The most common type is tic disorders, which can involve motor and phonic tics and are classified as simple or complex. Motor or phonic tics that persist for more than 1 year are defined as persistent (chronic) tic disorder. Tourette syndrome can be diagnosed if a child has multiple motor tics and at least one phonic tic for more than 1 year with onset before age 18 years. Children with Tourette syndrome may have symptoms of attention-deficit/hyperactivity disorder, obsessive-compulsive disorder, depression, or behavioral disorders. Chorea can be seen as a symptom of rheumatic fever (Sydenham chorea), in children with a history of kernicterus, and in dyskinetic cerebral palsy. Chorea also may be part of an underlying metabolic or genetic condition. Dystonia is characterized by repetitive contortions

and posturing of the limbs and body. It can be isolated or part of an underlying neurologic condition. Tremor can occur as a manifestation of essential tremor or can be an enhanced physiologic tremor exacerbated by drugs, illness, or stimulants. Ataxia most often is seen as a postinfectious or postvaccination acute cerebellar ataxia. Progressive ataxias are consistent with an underlying metabolic or genetic condition. Transient and developmental movement disorders include benign neonatal sleep myoclonus, jitteriness in neonates, shuddering, and stereotypies.

PMID: 36459665

**31. Metabolic patterns in brain 18F-fluorodeoxyglucose PET relate to aetiology in paediatric dystonia**
Stavros Tsagkaris, Eric K C Yau, Verity McClelland, Apostolos Papandreou, Ata Siddiqui, Daniel E Lumsden, Margaret Kaminska, Eric Guedj, Alexander Hammers, Jean-Pierre Lin

Brain. 2022 Nov 29;awac439. doi: 10.1093/brain/awac439. Online ahead of print.

There is a lack of imaging markers revealing the functional characteristics of different brain regions in paediatric dystonia. In this observational study, we assessed the utility of [18F]2-fluoro-2-deoxy-D-glucose (FDG)-PET in understanding dystonia pathophysiology by revealing specific resting awake brain glucose metabolism patterns in different childhood dystonia subgroups. PET scans from 267 children with dystonia being evaluated for possible Deep Brain Stimulation (DBS) surgery between September 2007 and February 2018 at Evelina London Children's Hospital (ELCH) United Kingdom were examined. Scans without gross anatomical abnormality (e.g. large cysts, significant ventriculomegaly; n = 240) were analysed with Statistical Parametric Mapping (SPM12). Glucose metabolism patterns were examined in the 144/240 (60%) cases with the ten commonest childhood-onset dystonias, focusing on nine anatomical regions. A group of thirty-nine adult controls was used for comparisons. The genetic dystonias were associated with the following genes: TOR1A, THAP1, SGCE, KMT2B, HPRT1 (Lesch Nyhan disease), PANK2 and GCDH (Glutaric Aciduria type 1). The acquired Cerebral Palsy (CP) cases were divided into those related to prematurity (CP-Preterm), neonatal jaundice/kernicterus (CP-Kernicterus) and hypoxic-ischaemic encephalopathy (CP-Term). Each dystonia subgroup had distinct patterns of altered FDG-PET uptake. Focal glucose hypometabolism of the pallidi, putamina, or both, was the commonest finding, except in PANK2, where basal ganglia metabolism appeared normal. HPRT1 uniquely showed glucose hypometabolism across all nine cerebral regions. Temporal lobe glucose hypometabolism was found in KMT2B, HPRT1 and CP-Kernicterus. Frontal lobe hypometabolism was found in SGCE, HPRT1, and PANK2. Thalamic and brainstem hypometabolism were seen only in HPRT1, CP-Preterm and CP-term dystonia cases. The combination of frontal and parietal lobe hypermetabolism was uniquely found in CP-term cases. PANK2 cases showed a distinct combination of parietal hypermetabolism with cerebellar hypometabolism but intact putaminal-pallidal glucose metabolism. HPRT1, PANK2, CP-kernicterus and CP-preterm cases had cerebellar and insula glucose hypometabolism as well as parietal glucose hypermetabolism. The study findings offer insights into the pathophysiology of dystonia and support the network theory for dystonia pathogenesis. "Signature" patterns for each dystonia subgroup could be a useful biomarker to guide differential diagnosis and inform personalised management strategies.

PMID: 36445406

**32. Neonatal motor functional connectivity and motor outcomes at age two years in very preterm children with and without high-grade brain injury**
Peppar E P Cyr, Rachel E Lean, Jeanette K Kenley, Sydney Kaplan, Dominique E Meyer, Jeffery J Neil, Dimitrios Alexopoulos, Rebecca G Brady, Joshua S Shimony, Thomas L Rodebaugh, Cynthia E Rogers, Christopher D Smyser

Neuroimage Clin. 2022 Nov 9;36:103260. doi: 10.1016/j.nicl.2022.103260. Online ahead of print.

Preterm-born children have high rates of motor impairments, but mechanisms for early identification remain limited. We hypothesized that neonatal motor system functional connectivity (FC) would relate to motor outcomes at age two years; currently, this relationship is not yet well-described in very preterm (VPT; born <32 weeks' gestation) infants with and without brain injury. We recruited 107 VPT infants - including 55 with brain injury (grade III-IV intraventricular hemorrhage, cystic periventricular leukomalacia, post-hemorrhagic hydrocephalus) - and collected FC data at/near term-equivalent age (35-45 weeks postmenstrual age). Correlation coefficients were used to calculate the FC between bilateral motor and visual cortices and thalami. At two years corrected-age, motor outcomes were assessed with the Bayley Scales of Infant and Toddler Development, 3rd edition. Multiple imputation was used to estimate missing data, and regression models related FC measures to motor outcomes. Within the brain-injured group only, interhemispheric motor cortex FC was positively related to gross motor outcomes. Thalamocortical and visual FC were not related to motor scores. This suggests neonatal alterations in motor

system FC may provide prognostic information about impairments in children with brain injury.

PMID: 36451363

**33. Long-term effects of prophylactic MgSO4 in maternal immune activation rodent model at adolescence and adulthood**

Fadwa Dabbah-Assadi, Sally Rashid, Idit Golani, Alon Rubinstein, Ravid Doron, David Alon, Eilam Palzur, Ron Beloosesky, Alon Shamir

J Neurosci Res. 2022 Nov 26. doi: 10.1002/jnr.25148. Online ahead of print.

The effects of MgSO4 as an anti-inflammatory agent in pregnant women have been investigated in the last few years. Infections can cause an inflammatory reaction involving the placenta membranes and amniotic cavity. They may have short-term effects on the mother and her fetuses, like preterm birth, cerebral palsy, and developmental delay. Despite the alleged advantages of MgSO4 as a neuroprotective agent in the preterm brain, the long-term molecular and behavioral function of MgSO4 has not been fully elucidated. Here, we investigated the long-term effect of antenatal MgSO4 , during late gestation, on offspring's behavior focusing on cognitive function, motor activity, and social cognition in adolescence and adulthood, and explored its influence on brain gene expression (e.g., ErbB signaling, pro-inflammatory, and dopaminergic markers) in adulthood. A significant abnormal exploratory behavior of offspring of MgSO4 -treated dams was found compared to the control group in both adolescence and adulthood. Furthermore, we found that adult females exposed to MgSO4 under inflammation displayed working and recognition memory impairment. A reduction in IL-6 expression was detected in the prefrontal cortex, and hippocampus specimens derived from LPS-Mg-treated group. In contrast, an imbalanced expression of dopamine 1 and 2 receptors was detected only in prefrontal cortex specimens. Besides, we found that MgSO4 ameliorated the overexpression of the Nrg1 and Erbb4 receptors induced by LPS in the hippocampus. Thus, MgSO4 treatment for preventing brain injuries can adversely affect offspring cognition behavior later in life, depending on the sex and age of the offspring.

PMID: 36434794