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Interventions and Management

1. Effectiveness of Action Observation Training on Upper Limb Motor Function in Children with Hemiplegic Cerebral Palsy: A Systematic Review of Randomized Controlled Trials

Abayneh Alamer, Haimanot Melese, Belaynew Adugna

Review Pediatric Health Med Ther. 2020 Sep 15;11:335-346. doi: 10.2147/PHMT.S266720. eCollection 2020.

The purpose of this review was to evaluate and examine the current best evidence for the effectiveness of action observation therapy on upper limb function rehabilitation in children with hemiplegic cerebral palsy. A comprehensive search of literature published between September 2010 and May 2020 was conducted using the following electronic databases: PubMed, Google Scholar, the Physiotherapy Evidence Database (PEDro), EMBASE, Cochrane library, and Scopus. Only randomized controlled trials evaluating the effect of action observation therapy on upper limb motor function in children with hemiplegic cerebral palsy were included. PEDro scale was used to assess the risk of bias of included trials. This study was reported according to the guideline of the PRISMA statement. The overall methodological quality of the studies was done using the PEDro scale and GRADE approach. The primary outcome measures of this review were the Melbourne Assessment Scale, Assisting Hand Assessment scale to evaluate physical function and structures. Furthermore, the ABILHAND-Kids test, and Box and Block Test primary outcome measures were used to determine the subjects' activities and participation. Nine randomized controlled trials involving 234 participants were analyzed. The overall quality of evidence was rated from moderate to high. This review suggests action observation therapy was found to be a promising intervention for upper limb rehabilitation in children with cerebral palsy.

PMID: [32982541](#)

2. A prospective study on transfer of pronator teres to extensor carpi radialis brevis for forearm and wrist deformity in children with cerebral palsy

Gobinder Singh, Vivek Singh, Sabeel Ahmad, R B Kalia, Shobha S Arora, Siddharth Dubey

J Hand Surg Eur Vol. 2020 Sep 29;1753193420960330. doi: 10.1177/1753193420960330. Online ahead of print.

We prospectively evaluated the clinical and functional outcomes of pronator teres to extensor carpi radialis brevis transfer in children with cerebral palsy. Patients were followed-up at 6 months postoperatively, and functionally assessed using the House classification, Manual Ability Classification System (MACS) and Upper Extremity Functional Index (UEFI). Fifteen children with a mean age of 8.1 years underwent tendon transfers. All patients were of Gschwind and Tonkin Grade 2 for pronation deformity; eight patients were of Zancolli's classification Group 1 and seven, Group 2 for wrist flexion deformity. The average gain in active supination was 67°, and wrist extension 15°. An increase of 7.0 in the UEFI score was recorded, although no significant improvement in MACS and House classification was observed. We conclude that the pronator teres to extensor carpi radialis brevis transfer improves upper limb function through effective correction of forearm pronation and

wrist flexion deformities. Level of evidence: II.

PMID: [32990136](#)

3. The Utility of Gait Deviation Index (GDI) and Gait Variability Index (GVI) in Detecting Gait Changes in Spastic Hemiplegic Cerebral Palsy Children Using Ankle-Foot Orthoses (AFO)

Majewska Joanna, Szczepanik Magdalena, Bazarnik-Mucha Katarzyna, Szymczyk Daniel, Lenart-Domka Ewa

Children (Basel). 2020 Sep 25;7(10):E149. doi: 10.3390/children7100149.

Background: Cerebral palsy (CP) children present complex and heterogeneous motor disorders that cause gait deviations. Clinical gait analysis (CGA) is used to identify, understand and support the management of gait deviations in CP. Children with CP often use ankle-foot orthosis (AFO) to facilitate and optimize their walking ability. The aim of this study was to assess whether the gait deviation index (GDI) and the gait variability index (GVI) results can reflect the changes of spatio-temporal and kinematic gait parameters in spastic hemiplegic CP children wearing AFO. **Method:** The study group consisted of 37 CP children with hemiparesis. All had undergone a comprehensive, instrumented gait analysis while walking, both barefoot and with their AFO, during the same CGA session. Kinematic and spatio-temporal data were collected and GVI and GDI gait indexes were calculated. **Results:** Significant differences were found between the barefoot condition and the AFO conditions for selected spatio-temporal and kinematic gait parameters. Changes in GVI and GDI were also statistically significant. **Conclusions:** The use of AFO in hemiplegic CP children caused a statistically significant improvement in spatio-temporal and kinematic gait parameters. It was found that these changes were also reflected by GVI and GDI. These findings might suggest that gait indices, such as GDI and GVI, as clinical outcome measures, may reflect the effects of specific therapeutic interventions in CP children.

PMID: [32992683](#)

4. Role of Rush rods in proximal femoral osteotomies for cerebral palsy

Sitanshu Barik, Vivek Singh

J Pediatr Orthop B. 2020 Nov;29(6):619. doi: 10.1097/BPB.0000000000000794.

PMID: [33003126](#)

5. Automatic Diagnosis of Cerebral Palsy Gait using Computational Intelligence Techniques: A Low-Cost Multi-Sensor Approach

Saikat Chakraborty, Anup Nandy

IEEE Trans Neural Syst Rehabil Eng. 2020 Oct 1;PP. doi: 10.1109/TNSRE.2020.3028203. Online ahead of print.

Automatic diagnosing of Cerebral Palsy (CP) gait is crucial in quantitative evaluation of a therapeutic intervention. Existing systems for such gait assessment are expensive and require user intervention. This study proposes a low-cost gait assessment system equipped with multiple Kinect sensors. Forty subjects (20 CP patients and 20 normal) were recruited for the experiment. To remove outlier frames from the combined gait signal of multiple sensors a data driven algorithm was proposed. Different supervised classifiers along with extreme learning machine were investigated to diagnose CP gait. In addition, a feature level analysis was also performed. Several spatio-temporal features (i.e. step length, stride length, stride time, etc.) were extracted. The strength of walking ratio, a speed invariant feature, to detect CP gait was thoroughly analyzed. The proposed system outperformed state-of-the-art with $\approx 98\%$ of accuracy (sensitivity: 100%, and specificity: 96.87%). Results indicate a substantial improvement in abnormality detection performance after outlier removal. Based on ReliefF feature ranking algorithm, walking ratio ranked the best among other classical gait features. Performance of all classifiers increased substantially using walking ratio as a feature. Extreme learning machine demonstrated a competing performance in all cases. The higher classification accuracy of this low-cost system using only a single feature makes it attractive for CP gait detection.

PMID: [33001807](#)

6. Effects of Kinect Video Game Training on Lower Extremity Motor Function, Balance, and Gait in Adolescents with Spastic Diplegia Cerebral Palsy: A Pilot Randomized Controlled Trial

SunHye Jung, SunHae Song, DongGeon Lee, Kyeongbong Lee, GyuChang Lee

Dev Neurorehabil. 2020 Sep 27;1-7. doi: 10.1080/17518423.2020.1819458. Online ahead of print.

The Kinect video game (KVG) has received attention as an intervention method for cerebral palsy (CP). However, evidence remains limited. Purpose: To investigate the effects of training using Xbox Kinect on lower extremity motor function, balance, and gait in adolescents with spastic diplegia CP. Methods: This study was a pilot randomized controlled trial. Ten participants were randomly allocated to either the KVG training group (n = 5) or the conventional training (CT) group (n = 5). The Selective Control Assessment of the Lower Extremity (SCALE) tool, Pediatric Balance Scale (PBS), and GAITRite were used for the outcome measurements. Results: In the comparison between the groups, the KVG group showed significant improvements in all the items in the SCALE (except for right hip abduction) and PBS score as compared with the CT group. Conclusions: KVG training might be an effective intervention for the rehabilitation of adolescents with spastic diplegia CP.

PMID: [32981401](#)

7. Competitive sport, therapy, and physical education: voices of young people with cerebral palsy who have high support needs

Eimear Enright, Emma M Beckman, Mark J Connick, Iain Mayank Dutia, Angelo Macaro, Paula J Wilson, Jennifer O'Sullivan, Jean-Michel Lavalliere, Turner Block, Leanne M Johnston, Gaj Panagoda, Sean M Tweedy

Editorial Br J Sports Med. 2020 Sep 28;bjssports-2020-102276. doi: 10.1136/bjssports-2020-102276. Online ahead of print.

PMID: [32988931](#)

8. Differences in Leisure Physical Activity Participation in Children with Typical Development and Cerebral Palsy

Fabio Vila-Nova, Cristina Dos Santos Cardoso de Sá, Raul Oliveira, Rita Cordovil

Dev Neurorehabil. 2020 Sep 27;1-7. doi: 10.1080/17518423.2020.1819461. Online ahead of print.

Aim: To compare participation in leisure physical activities in children with typical development (TD) and cerebral palsy (CP). Methods: A total of 170 children with TD (n = 101) and CP (n = 69) aged 8 to 18 years reported participation in 16 extracurricular physical activities. Non-parametric statistics examined differences between groups. Results: Children with TD participated more frequently in individual physical activities (p = .018), team sports (p = .026), and bicycling (p = .001), and less in horseback riding (p = .031) than children with CP in GMFCS II-V. The differences between children with TD and CP in GMFCS I and within the CP group were not statistically significant. We did not find differences between groups in enjoyment. Conclusion: Children with CP in GMFCS II-V tend to participate less in leisure physical activities that require higher motor and perceptual skills. Support in the adaptation of physical recreation and sports may help improve participation.

PMID: [32981411](#)

9. Throwing distance and competitive performance of Boccia players

Masataka Kataoka, Kuniharu Okuda, Akira Iwata, Shuji Imura, Kosuke Yahagi, Yohei Matsuo

J Phys Ther Sci. 2020 Sep;32(9):574-577. doi: 10.1589/jpts.32.574. Epub 2020 Sep 1.

[Purpose] This study aimed to clarify the relationship between throwing distance and competitive performance in Boccia players in order to establish a training program based on this evidence. [Participants and Methods] In total, 40 athletes, who

competed in the Japan Boccia Championships and are certified players of the Japan Boccia Association, participated in the study. Participants threw the Boccia ball as far as possible, and throwing distances were compared between certified players (Group I, n=8), those who participated in the final round (Group II, n=9), and those who lost in the preliminary round (Group III, n=23). [Results] The maximum throwing distances were 16.38 ± 5.17 m (Group I), 10.67 ± 2.66 m (Group II), and 8.34 ± 2.73 m (Group III). Group I threw the ball significantly farther than Groups II and III. [Conclusion] Boccia is a target sport and throwing farther distances requires more effort. In addition, being able to throw at a longer distance means that Boccia players can throw a stronger ball and use this for various tactics. The results of this study suggest that long-distance throwing training would be effective in improving the competitive performance of Boccia players.

PMID: [32982053](#)

10. Intraobserver Reliability and Construct Validity of the Squat Test in Children With Cerebral Palsy

Maaikje M Eken, Annet J Dallmeijer, Annemieke I Buizer, Saskia Hogervorst, Kim van Hutten, Marjolein Piening, Marjolein van der Krogt, Han Houdijk

Pediatr Phys Ther. 2020 Oct;32(4):399-403. doi: 10.1097/PEP.0000000000000736.

Purpose: This study evaluated intraobserver reliability and construct validity of the squat test to assess lower extremity strength in children with cerebral palsy (CP) and spastic diplegia. **Methods:** Children with CP performed 2 trials of the squat test and calculated the intraclass correlation coefficient to evaluate intraobserver reliability. Correlations between outcomes of hand-held dynamometry (HHD) of knee extensor strength and an 8-repetition maximum (8RM) leg press test and the squat test were calculated to evaluate construct validity. **Results:** Excellent intraobserver reliability was observed for the squat test. Correlations between squat test performance and HHD knee extension and 8RM leg press test demonstrated good construct validity. **Conclusions:** The squat test is a reliable and valid tool to assess lower extremity strength in children with CP and spastic diplegia. The squat test is inexpensive and less time-consuming, and therefore particularly suitable for clinicians.

PMID: [32991569](#)

11. Commentary on "Intraobserver Reliability and Construct Validity of the Squat Test in Children With Cerebral Palsy"

Lee Ann Magiera, Jill C Heathcock

Comment Pediatr Phys Ther. 2020 Oct;32(4):404. doi: 10.1097/PEP.0000000000000737.

PMID: [32991570](#)

12. Sedentary Behavior in Children With Cerebral Palsy Between 1.5 and 12 Years: A Longitudinal Study.

Reedman SE, Johnson E, Sakzewski L, Gomersall S, Trost SG, Boyd RN.

Pediatr Phys Ther. 2020 Oct;32(4):367-373. doi: 10.1097/PEP.0000000000000740.

PMID: [32773523](#)

13. Commentary on "Sedentary Behavior in Children With Cerebral Palsy Between 1.5 and 12 Years: A Longitudinal Study"

Brittany Anderson

Comment Pediatr Phys Ther. 2020 Oct;32(4):374. doi: 10.1097/PEP.0000000000000747.

PMID: [32991563](#)

14. Oral health care for children and adolescents with cerebral palsy: perceptions of parents and caregivers [Article in Portuguese, En]

Elizabeth Louisy Marques Soares da Silva, Paulo Sávio Angeiras de Góes, Márcia Maria Vendiciano Barbosa Vasconcelos, Silvia Regina Jamelli, Sophie Helena Eickmann, Márcia Maria Dantas Cabral de Melo, Marília de Carvalho Lima

Cien Saude Colet. 2020 Oct;25(10):3773-3784. doi: 10.1590/1413-812320202510.27972018. Epub 2019 Feb 13.

The aim was to evaluate the oral health care of children/adolescents with Cerebral Palsy (CP) according to severity through the perceptions of parents/caregivers. A case series study was conducted at health services in the state of Pernambuco, Brazil with 94 mothers/caregivers of subjects with CP from 5 and 18 years old. Sociodemographic factors, oral health care and use of dental services (DS) were evaluated. The Gross Motor Function Classification System showed 67% with severe motor impairment. Subjects with severe CP had significantly higher frequencies of belonging to families with lower income (89%, $p < 0.001$), living in the interior (44%, $p < 0.005$), having transportation difficulties (60%, $p = 0.04$), difficulty regarding access to DS (88%, $p = 0.009$) and a greater need for oral hygiene (67%, $p = 0.008$), which was performed exclusively by the caregiver (94%, $p < 0.001$). Despite identified access barriers, dental care was facilitated for those with severe CP, early DS use, but low availability of dentists and low degree of humanization were cited as major problems. These results reveal problems related to daily oral health care, family living context, institutional support and quality of DS that should be addressed in comprehensive, inclusive, equitable social and economic public policies.

PMID: [32997011](#)

15. Lactobacillus reuteri DSM 17938 and Agave Inulin in Children with Cerebral Palsy and Chronic Constipation: A Double-Blind Randomized Placebo Controlled Clinical Trial

Andrea A García Contreras, Edgar M Vásquez Garibay, Carmen A Sánchez Ramírez, Mary Fafutis Morris, Vidal Delgado Rizo

Nutrients. 2020 Sep 28;12(10):E2971. doi: 10.3390/nu12102971.

The main objective was to assess the efficacy of a probiotic (*Lactobacillus reuteri* DSM 17938), a prebiotic (agave inulin), and a synbiotic on the stool characteristics in children with cerebral palsy and chronic constipation. Thirty-seven children with cerebral palsy and chronic constipation were included. The probiotic group received 1×10^8 colony forming unit (cfu) of *L. reuteri* DSM 17938 plus placebo, the prebiotic group received 4 g of agave inulin plus placebo, the synbiotic group received *L. reuteri* DSM 17938 plus agave inulin, and the placebo group received two placebos for 28 days. The probiotic group showed a significant decrease in stool pH ($p = 0.014$). Stool consistency improved in the prebiotic group ($p = 0.008$). The probiotic, prebiotic, and synbiotic groups showed a significant improvement in the history of excessive stool retention, the presence of fecal mass in the rectum, and the history of painful defecation. *L. reuteri* concentration in feces was higher in the probiotic group than in the placebo group ($p = 0.001$) and showed an inverse correlation with stool pH in the probiotic group ($r = -0.762$, $p = 0.028$). This study showed that the use of *L. reuteri* DSM 17938 and/or agave inulin improved the stool characteristics such as the history of painful defecation and the presence of fecal mass in the rectum against placebo in children with cerebral palsy and chronic constipation.

PMID: [32998471](#)

16. Structural brain damage and visual disorders in children with cerebral palsy due to periventricular leukomalacia

Francesca Tinelli, Andrea Guzzetta, Giulia Purpura, Rosa Pasquariello, Giovanni Cioni, Simona Fiori

Neuroimage Clin. 2020 Sep 11;28:102430. doi: 10.1016/j.nicl.2020.102430. Online ahead of print.

Aim: To systematically explore the relationship between type and severity of brain lesion on Magnetic Resonance Imaging (MRI) and visual function in a large cohort of children with periventricular leukomalacia (PVL). Methods: 94 children with

bilateral cerebral palsy (CP) and history of PVL were recruited at Stella Maris Scientific Institute in Pisa (Italy). We included data of participants (72) with at least one MRI after the age of three years and an evaluation of visual function including fixation, following, saccades, nystagmus, acuity, visual field, stereopsis and color perception. Brain lesions location and extent were assessed by a semi-quantitative MRI-scale for children with CP. Results: Brain lesion severity strongly correlated with visual function total score (global MRI score $p = .000$; hemispheric score $p = .001$ and subcortical score $p = .000$). Moreover, visual acuity, visual field, stereopsis and colour were compromised when a cortical damage was present, while ocular motricity (and in particular fixation and saccades) were compromised in presence of subcortical brain damage. Interpretation: Structural MRI is valuable for understanding the relationship between brain lesion severity and visual function in children with CP.

PMID: [32980597](#)

17. The Effect of Laser Acupuncture on Spasticity in Children with Spastic Cerebral Palsy

Dian Eka Putri, Adiningsih Srilestari, Kemas Abdurrohman, Irawan Mangunatmadja, Luh Karunia Wahyuni

J Acupunct Meridian Stud. 2020 Sep 24;S2005-2901(20)30136-9. doi: 10.1016/j.jams.2020.09.001. Online ahead of print.

Background: Spasticity in cerebral palsy is one of the most common disabilities of children in developing countries. Objectives: The objective of this study was to determine the efficacy of laser acupuncture on spasticity in children with spastic cerebral palsy. Methods: This clinical trial was conducted on 60 spastic cerebral palsy patients at 2 to 10 years. The patients were categorized into two groups, control group and treatment group. Laser acupuncture was applied on GV20, GV14, LI4, GB34 and LR3 (power 50 mW, 785 nm, 1 Joule, 40 seconds) three times a week for 12 sessions in treatment group and placebo laser acupuncture on the same points in control group. The spasticity was measured using Modified Ashworth Scale (MAS) before and after complete sessions. Results: The results showed that there was a significant reduction in MAS score in treatment group compared to control group ($p=0.003$). Conclusions: This study suggest that laser acupuncture on GV20, GV14, LI4, GB34 and LR3 can reduce spasticity for children with spastic cerebral palsy.

PMID: [32980558](#)

18. Motor imagery in children with unilateral cerebral palsy: a case-control study

Deisiane O Souto, Thalita K F Cruz, Patrícia L B Fontes, Vitor G Haase

Dev Med Child Neurol. 2020 Sep 29. doi: 10.1111/dmcn.14672. Online ahead of print.

Aim: To evaluate whether children with cerebral palsy (CP) are able to engage in a motor imagery task. Possible associations between motor imagery and functional performance, working memory, age, and intelligence were also investigated. Method: This is a case-control study that assessed 57 children (25 females, 32 males) with unilateral CP, aged 6 to 14 years (mean age: 10y 4mo; SD 2y 8mo) and 175 typically developing (control) children, aged 6 to 13 years (87 females, 88 males; mean age: 9y 4mo; SD 1y 11mo). The hand laterality judgment task was used to measure motor imagery ability. Reaction time, accuracy, and the effect of the biomechanical constraints were assessed in this task. Results: Performance in both groups followed the biomechanical constraints of the task, that is, longer reaction times to recognize stimuli rotated laterally when compared to medial stimuli. Reaction time means did not differ significantly between groups ($p>0.05$). Significant differences between the unilateral CP and control groups were observed for accuracy ($p<0.05$). Functional performance and working memory were correlates of motor imagery tasks. Interpretation: Results suggest that children with unilateral CP can engage in motor imagery; however, they commit more errors than typically developing controls. In addition, their performance in tasks of motor imagery is influenced by functional performance and working memory.

PMID: [32996138](#)

19. Towards an intuitive communication-BCI: decoding visually imagined characters from the early visual cortex using high-field fMRI

Max A van den Boom, Mariska J Vansteensel, Melissa I Koppeschaar, Matthijs A H Raemaekers, Nick F Ramsey

Biomed Phys Eng Express. 2019 Aug 2;5(5):055001. doi: 10.1088/2057-1976/ab302c. eCollection 2019 Aug.

Brain-computer interfaces aim to provide people with paralysis with the possibility to use their neural signals to control devices. For communication, most BCIs are based on the selection of letters from a (digital) letter board to spell words and sentences. Visual mental imagery of letters could offer a new, fast and intuitive way to spell in a BCI-communication solution. Here we provide a proof of concept for the decoding of visually imagined characters from the early visual cortex using 7 Tesla functional MRI. Sixteen healthy participants visually imagined three different characters for 3, 5 and 7 s in a slow event-related design. Using single-trial classification, we were able to decode the characters with an average accuracy of 54%, which is significantly above chance level (33%). Furthermore, the imagined characters were classifiable shortly after cue onset and remained classifiable with prolonged imagery. These properties, combined with the cortical location of the early visual cortex and its decodable activity, encourage further research on intracranial interfacing using surface electrodes to bring us closer to such a visual imagery based BCI communication solution.

PMID: [32983573](#)

20. Creating a response space in multiparty classroom settings for students using eye-gaze accessed speech-generating devices

Helena Tegler, Ingrid Demmelmaier, Monica Blom Johansson, Niklas Norén

Augment Altern Commun. 2020 Sep 29;1-11. doi: 10.1080/07434618.2020.1811758. Online ahead of print.

Conversation Analysis was used to explore how teachers, personal care assistants, and students organized inclusive multiparty classroom interaction when one of the students in the classroom used an eye-gaze accessed speech-generating device (SGD). Scaffolding and collaborative practices that created a response space for the construction of the eye-gaze accessed SGD-mediated turn were identified and analyzed. The participants were two adolescent students with severe cerebral palsy and intellectual disability who relied on eye-gaze accessed SGDs, and their teachers, personal care assistants, and classmates with intellectual disabilities. The data consisted of 2 hr and 40 min of video recordings collected in the participants' classrooms. Three practices were identified (a) the practice of explicit turn allocation organization and the use of display questions, (b) the practice of locally contingent on-screen scaffolding activities, and (c) the practice of dealing with turn competition by classmates. Teacher and assistant practices differed with regard to the student's access to the vocabulary relevant to answering the teacher's question. The practices were found to create a response space for students using SGDs accessed via eye gaze, thereby ensuring their educational inclusion in the classroom.

PMID: [32990060](#)

21. Effect of Combined Therapy of Virtual Reality and Transcranial Direct Current Stimulation in Children and Adolescents With Cerebral Palsy: A Study Protocol for a Triple-Blinded Randomized Controlled Crossover Trial

Talita Dias da Silva, Anne Michelli Gomes Gonçalves Fontes, Barbara Soares de Oliveira-Furlan, Tatiane Tedeschi Roque, Ana Izabel Izidório Lima, Bruna Mayara Magalhães de Souza, Camila Aparecida de Oliveira Alberissi, Ana Clara Silveira, Íbis Ariana Peña de Moraes, Johnny Collett, Roger Pereira Silva, Marina Junqueira Airoidi, Denise Cardoso Ribeiro-Papa, Helen Dawes, Carlos Bandeira de Mello Monteiro

Front Neurol. 2020 Sep 2;11:953. doi: 10.3389/fneur.2020.00953. eCollection 2020.

Background: Transcranial direct current stimulation (tDCS) and therapy-based virtual reality (VR) have been investigated separately. They have shown promise as efficient and engaging new tools in the neurological rehabilitation of individuals with cerebral palsy (CP). However, the recent literature encourages investigation of the combination of therapy tools in order to potentiate clinic effects and its mechanisms. Methods: A triple-blinded randomised sham-controlled crossover trial will be performed. Thirty-six individuals with gross motor function of levels I to IV (aged 4-14 years old) will be recruited. Individuals will be randomly assigned to Group A (active first) or S (sham first): Group A will start with ten sessions of active tDCS combined with VR tasks. After a 1-month washout, this group will be reallocated to another ten sessions with sham tDCS combined with VR tasks. In contrast, Group S will carry out the opposite protocol, starting with sham tDCS. For the active tDCS the protocol will use low frequency tDCS [intensity of 1 milliampere (mA)] over the primary cortex (M1) area on the dominant side of the brain. Clinical evaluations (reaction times and coincident timing through VR, functional scales: Abilhand-Kids, ACTIVLIM-CP, Paediatric Evaluation of Disability Inventory-PEDI- and heart rate variability-HRV) will be performed

at baseline, during, and after active and sham tDCS. Conclusion: tDCS has produced positive results in treating individuals with CP; thus, its combination with new technologies shows promise as a potential mechanism for improving neurological functioning. The results of this study may provide new insights into motor rehabilitation, thereby contributing to the better use of combined tDCS and VR in people with CP. Trial Registration: ClinicalTrials.gov, NCT04044677. Registered on 05 August 2019.

PMID: [32982950](#)

22. Group B Streptococcal disease in England (1998 - 2017): a population based observational study

Seilesh Kadambari, Caroline L Trotter, Paul T Heath, Michael J Goldacre, Andrew J Pollard, Raphael Goldacre

Clin Infect Dis. 2020 Sep 29;ciaa1485. doi: 10.1093/cid/ciaa1485. Online ahead of print.

Background and objectives: Group B Streptococcus (GBS) is the leading cause of sepsis and meningitis in infants <90 days. In this study, the burden of GBS disease and mortality in young infants in England was assessed. Methods: Using linked hospitalisation records from every National Health Service (NHS) hospital from 1 April 1998 to 31 March 2017, we calculated annual GBS incidence in infants aged <90 days and, using regression models, compared their perinatal factors, rates of hospital-recorded disease outcomes and all-cause infant mortality rates with those of the general infant population. Results: 15,429 infants aged <90 days had a hospital-recorded diagnosis of GBS, giving an average annual incidence of 1.28 per 1000 live births (95% CI 1.26-1.30) with no significant trend over time. GBS-attributable mortality declined significantly from 0.044 (95%CI 0.029-0.065) per 1000 live births in 2001 to 0.014 (95%CI 0.010-0.026) in 2017 (annual percentage change -6.6, 95% CI -9.1 to -4.0). Infants with GBS had higher relative rates of visual impairment (HR 7.0 95% CI 4.1-12.1), cerebral palsy (HR 9.3 95% CI 6.6-13.3), hydrocephalus (HR 17.3 95% CI 13.8-21.6) and NEC (HR 18.8 95% CI 16.7-21.2) compared with those without GBS. Conclusions: Annual rates of GBS disease in infants have not changed over 19 years. The reduction in mortality is likely multifactorial and due to widespread implementation of antibiotics in at-risk mothers and babies as well as advances in managing acutely unwell infants. New methods for prevention, such as maternal vaccination, must be prioritised.

PMID: [32989454](#)

23. Relationships among parenting stress, health-promoting behaviors, and health-related quality of life in Korean mothers of children with cerebral palsy

Meen Hye Lee, Alicia K Matthews, Chang Gi Park, Catherine Vincent, Kelly Hsieh, Teresa A Savage

Res Nurs Health. 2020 Sep 29. doi: 10.1002/nur.22074. Online ahead of print.

Health-promoting behaviors have been shown to enhance the quality of life across diverse populations. In this study, we examined the indirect effects of several health-promoting behaviors on the relationship between parenting stress and health-related quality of life in mothers of children with cerebral palsy (CP). A convenience sample of Korean mothers (N = 180) of children aged 10 months to 12 years with CP was recruited from clinical and school settings. Health-promoting behaviors were measured using the health-promoting lifestyle profile II, which is comprised of six subscales: health responsibility, physical activity, nutrition, spiritual growth, interpersonal relations, and stress management. Multiple mediation analyses were conducted to examine the mediating role of these behavioral categories. Spiritual growth ($\beta = .56$, $p < .05$) had an indirect effect on the relationship between parenting stress and physical health-related quality of life while spiritual growth ($\beta = -1.00$, $p < .01$) and stress management ($\beta = -.80$, $p < .05$) were found to mediate the association between parenting stress and mental health-related quality of life. The findings of multiple mediation analyses provide evidence of the influence of specific health-promoting behaviors on health-related quality of life, thereby informing the development of intervention programs for mothers of children with disabilities.

PMID: [32990995](#)

24. Rasch Analysis of the Korean Parenting Stress Index Short Form (K-PSI-SF) in Mothers of Children with Cerebral Palsy

Eun-Young Park, Soojung Chae

Int J Environ Res Public Health. 2020 Sep 25;17(19):E7010. doi: 10.3390/ijerph17197010.

The purpose of this study was to investigate the psychometric characteristics of the Korean Parenting Stress Index Short Form (K-PSI-SF) for mothers of children with cerebral palsy (CP) by using a Rasch analysis. The participants were 114 mothers of children with CP whose ages ranged from 2.79 to 11.90 years. The K-PSI-SF consists of 36 items, with a 5-point Likert scale grading along three subscales (Parent Distress, Parent-Child Dysfunctional Interaction, and Difficult Child). The response data were analyzed, and we determined the item fitness and item difficulty, rating scale fit, and separation index. The results show that two items did not have the required fitness. After these two items were deleted, the means of the 34 items in two of the subscales were statistically different from those of the original 36 items. Our analysis of the item difficulty identified the need to add easier question items. The 5-point Likert scale used in the questionnaire was found to be appropriate. This significance of this study is that it suggested the need to modify item fitness and difficulty level, as it identified the psychometric characteristics of the K-PSI-SF through a Rasch analysis based on the item response theory.

PMID: [32992736](#)

25. Sensory Processing, Functional Performance and Quality of Life in Unilateral Cerebral Palsy Children: A Cross-Sectional Study

Patricia Jovellar-Isiegas, Inés Resa Collados, Diego Jaén-Carrillo, Luis Enrique Roche-Seruendo, César Cuesta García

Int J Environ Res Public Health. 2020 Sep 28;17(19):E7116. doi: 10.3390/ijerph17197116.

Background: The study of children with unilateral cerebral palsy (UCP) has traditionally focused on motor aspects. The extent to which sensory processing disorders can affect their functional performance and quality of life (QoL) is uncertain. This study aimed to explore the differences in sensory processing between UCP and typical development (TD) children and to analyze the relationship of sensory processing with functional performance and QoL. **Methods:** Fifty-three children aged from 6 to 15 years (TD = 24; UCP = 26) were recruited. The Child Sensory Profile 2, Pediatric Evaluation of Disability Inventory-Computer Adaptive Test and Kidscreen were used to evaluate sensory processing, functional performance and QoL. **Results:** UCP children showed sensory processing difficulties (avoidance: $p = 0.02$; registration: $p = 0.00$; body position: $p = 0.00$; oral: $p = 0.02$; social-emotional: $p = 0.01$), and scored lower in functional performance (daily activities: $p = 0.00$; mobility: $p = 0.00$; social/cognitive: $p = 0.04$) and in physical well-being ($p = 0.00$). The highest correlations in UCP group were found between proprioceptive processing and daily activities and mobility ($r = -0.39$); auditory, visual and tactile information and school environment ($r = -0.63$; $r = -0.51$; $r = -0.46$); behavioral and social-emotional responses and psychological well-being ($r = -0.64$; $r = -0.49$). **Conclusions:** UCP children have greater difficulty in sensory processing than TD children. Difficulties in proprioceptive processing contribute to poorer functional performance. Auditory, visual and tactile processing is associated with participation in the school environment and behavioral and social-emotional responses related to sensory processing are associated with the psychological well-being.

PMID: [32998414](#)

26. Construct-concurrent validity and reliability of the European Child Environment Questionnaire (ECEQ) in a sample of Turkish children with cerebral palsy

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Purpose: To investigate the construct-concurrent validity and reliability of the Turkish version of the European Child Environment Questionnaire (ECEQ-T) in children with cerebral palsy (CP). **Methods:** Mean age 9.53 ± 4.45 years 306 children with CP and their parents participated in the study. While construct validity was assessed using confirmatory factor analysis, concurrent validity was investigated using the correlation between ECEQ-T and Pediatric Evaluation of Disability Inventory (PEDI) with Spearman's correlation analysis. For test-retest reliability, ECEQ-T was administered twice to 65 parents with an interval of two weeks. Cronbach's alpha (α) and Intraclass Correlation Coefficient (ICC) were used for reliability. **Results:** Construct validity (RMSEA > 0.080 ; GFI ≥ 0.90) and concurrent validity ($r: -0.533$ to -0.293 ; $p < 0.05$) were confirmed as acceptable. Eight items were dropped out as they did not fit the model and finally ECEQ-T contains 54 items in three domains. High Cronbach's α and ICC values were found (Cronbach α PE: 0.960/ICCPE: 0.959, Cronbach α SS: 0.955/ICCSS: 0.954), Cronbach α A: 0.822/ICCA: 0.802, Cronbach α T: 0.957/ICCT: 0.955). **Conclusion:** ECEQ-T has demonstrated good

psychometric properties and can be used as a reliable and valid measure to assess environmental factors. We believe that ECEQ-T is a useful and detailed questionnaire to determine barriers-facilitators for increasing activity and participation in Turkish children with CP. **IMPLICATIONS FOR REHABILITATION** The Turkish version of ECEQ has acceptable construct validity and moderate concurrent validity for evaluating environmental factors in children with cerebral palsy. The Turkish version of ECEQ provides valuable information, which could be helpful to guide public health services and government policies in order to optimize the participation of children with CP. Environmental factors may play an important role in activity and participation in children with cerebral palsy. Turkish version of the ECEQ can be used for evaluating the environmental factors to determine barriers of activity and participation.

PMID: [32988240](#)

27. No-fault compensation for cerebral palsy associated with pregnancy care in Japan

Shin Ushiro, Philip J Steer

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PMID: [33006804](#)

28. Motor outcome after perinatal stroke and early prediction of unilateral spastic cerebral palsy

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Eur J Paediatr Neurol. 2020 Sep 21;S1090-3798(20)30185-9. doi: 10.1016/j.ejpn.2020.09.002. Online ahead of print.

Background: Unilateral spastic cerebral palsy (USCP) occurs in 30%-68% of infants with perinatal stroke. Early detection of USCP is essential for referring infants to early intervention. The aims of this study were to report motor outcomes after perinatal stroke, and to determine the predictive value of the General Movements Assessment (GMA) and Hand Assessment for Infants (HAI) for detection of USCP. Materials and methods: This was a prospective observational study involving infants with perinatal stroke. GMA was conducted between 10 and 15 weeks post term-age (PTA). The HAI was performed between 3 and 5 months PTA. Motor outcome was collected between 12 and 36 months PTA. Results: The sample consisted of 46 infants. Fifteen children (32.6%) were diagnosed with CP, two children with bilateral CP and 13 with USCP. Abnormal GMA had a sensitivity of 85% (95% confidence interval [CI] 55-98%) and a specificity of 52% (95% CI 33-71%) to predict USCP. When asymmetrically presented FMs were also considered as abnormal, sensitivity increased to 100%, hence the specificity declined to 43%. A HAI asymmetry index cut-off of 23, had both a sensitivity and a specificity of 100% to detect USCP. Conclusion: Using GMA and HAI can enable prediction of USCP before the age of 5 months in infants with perinatal stroke. Nevertheless, GMA must be interpreted with caution in this particular population. The HAI was found to be a very accurate screening tool for early detection of asymmetry and prediction of USCP.

PMID: [32988734](#)

29. Status Dystonicus: A Rare Manifestation of Cerebral Palsy - Correspondence

Prateek Kumar Panda, Indar Kumar Sharawat

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PMID: [33006118](#)

30. Management of Clinical Chorioamnionitis: An Evidence-Based Approach

Agustin Conde-Agudelo, Roberto Romero, Eun Jung Jung, Angel Jose Garcia Sanchez

Review Am J Obstet Gynecol. 2020 Sep 29;S0002-9378(20)31167-4. doi: 10.1016/j.ajog.2020.09.044. Online ahead of print.

The aim of this review was to examine the existing evidence about interventions proposed for the treatment of clinical chorioamnionitis, with the goal of developing an evidence-based contemporary approach for the management of this condition. Most trials that assessed the use of antibiotics in clinical chorioamnionitis included patients with a gestational age ≥ 34 weeks and in labor. The first-line antimicrobial regimen for the treatment of clinical chorioamnionitis is ampicillin combined with gentamicin, which should be initiated during the intrapartum period. In the event of a cesarean delivery, patients should receive clindamycin at the time of umbilical cord clamping. The administration of additional antibiotic therapy does not appear to be necessary after vaginal or cesarean delivery. However, if post-delivery antibiotics are prescribed, there is support for the administration of an additional dose. Patients should receive antipyretics, mainly acetaminophen, even though there is no clear evidence of their benefits. Current evidence suggests that the administration of antenatal corticosteroids for fetal lung maturation and of magnesium sulfate for fetal neuroprotection to patients with clinical chorioamnionitis between 24 0/7 and 33 6/7 weeks of gestation, and possibly between 23 0/7 and 23 6/7 weeks, has an overall beneficial effect on the infant. However, delivery should not be delayed in order to complete the full course of corticosteroids and magnesium sulfate. Once the diagnosis of clinical chorioamnionitis has been established, delivery should be considered, regardless of the gestational age. Vaginal delivery is the safer option and cesarean delivery should be reserved for standard obstetric indications. The time interval between the diagnosis of clinical chorioamnionitis and delivery is not related to most adverse maternal and neonatal outcomes. Patients may require a higher dose of oxytocin to achieve adequate uterine activity and/or greater uterine activity to effect a given change in cervical dilation. The benefit of using continuous electronic fetal heart rate monitoring in these patients is unclear. We identified the following promising interventions for the management of clinical chorioamnionitis: (1) an antibiotic regimen including ceftriaxone, clarithromycin, and metronidazole that provides coverage against the most commonly identified microorganisms in patients with clinical chorioamnionitis; (2) vaginal cleansing with antiseptic solutions before cesarean delivery with the aim of decreasing the risk of endometritis and, possibly, postoperative wound infection; and (3) antenatal administration of N-acetylcysteine, an antioxidant and anti-inflammatory agent, to reduce neonatal morbidity and mortality. Well-powered randomized controlled trials are needed to assess these interventions in patients with clinical chorioamnionitis.

PMID: [33007269](#)

31. Mutations disrupting neuritegenesis genes confer risk for cerebral palsy

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In addition to commonly associated environmental factors, genomic factors may cause cerebral palsy. We performed whole-exome sequencing of 250 parent-offspring trios, and observed enrichment of damaging de novo mutations in cerebral palsy cases. Eight genes had multiple damaging de novo mutations; of these, two (TUBA1A and CTNNA1) met genome-wide significance. We identified two novel monogenic etiologies, FBXO31 and RHOB, and showed that the RHOB mutation enhances active-state Rho effector binding while the FBXO31 mutation diminishes cyclin D levels. Candidate cerebral palsy risk genes overlapped with neurodevelopmental disorder genes. Network analyses identified enrichment of Rho GTPase, extracellular matrix, focal adhesion and cytoskeleton pathways. Cerebral palsy risk genes in enriched pathways were shown to regulate neuromotor function in a *Drosophila* reverse genetics screen. We estimate that 14% of cases could be attributed to an excess of damaging de novo or recessive variants. These findings provide evidence for genetically mediated dysregulation of early neuronal connectivity in cerebral palsy.

PMID: [32989326](#)