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Interventions and Management

1. Effects of Combining Constraint-Induced Movement Therapy and Action-Observation Training on Upper Limb Kinematics in Children With Unilateral Cerebral Palsy: A Randomized Controlled Trial

Cristina Simon-Martinez, Lisa Maillieux, Ellen Jaspers, Els Ortibus, Kaat Desloovere, Katrijn Klingels, Hilde Feys

Sci Rep. 2020 Jun 26;10(1):10421. doi: 10.1038/s41598-020-67427-2.

Modified constraint-induced movement therapy (mCIMT) improves upper limb (UL) motor execution in unilateral cerebral palsy (uCP). As these children also show motor planning deficits, action-observation training (AOT) might be of additional value. Here, we investigated the combined value of AOT to mCIMT on UL kinematics in children with uCP in a randomized controlled trial. Thirty-six children with uCP completed an UL kinematic and clinical evaluation after participating in a 9-day mCIMT camp wearing a splint for 6 h/day. The experimental group (mCIMT + AOT, n = 20) received 15 h of AOT, i.e. video-observation and execution of unimanual tasks. The control group (mCIMT + placebo, n = 16) watched biological-motion free videos and executed the same tasks. We examined changes in motor control (movement duration, peak velocity, time-to-peak velocity, and trajectory straightness) and kinematic movement patterns (using Statistical Parametric Mapping) during the execution of three unimanual, relevant tasks before the intervention, after and at 6 months follow-up. Adding AOT to mCIMT mainly affected movement duration during reaching, whereas little benefit is seen on UL movement patterns. mCIMT, with or without AOT, improved peak velocity and trajectory straightness, and proximal movement patterns. Clinical and kinematic improvements are poorly related. Although there seem to be limited benefits of AOT to CIMT on UL kinematics, our results support the inclusion of kinematics to capture changes in motor control and movement patterns of the proximal joints.

PMID: [32591590](#)

2. Stereotactic Dorsolateral Irradiation of Spinal Nerve Roots: A Novel Technique for the Treatment of Spasticity and Pain

Pantaleo Romanelli, Giancarlo Beltramo

Case Reports Cureus. 2020 May 27;12(5):e8323. doi: 10.7759/cureus.8323.

Selective dorsal rhizotomy is an established surgical treatment to improve the neurological and functional status of children with spastic cerebral palsy and adults with spasticity and pain caused by a variety of brain and spinal injuries. This procedure requires a dorsolumbar laminectomy to expose the appropriate dorsal rootlets, which are sectioned according to the presence of sustained electromyographic discharges. Image-guided robotic radiosurgery targeting the intracisternal sensory root of the trigeminal nerve has been described as a safe and effective non-invasive treatment for trigeminal neuralgia, a paroxysmic pain disorder which often responds poorly to medical therapy. Image-guided radiosurgery requires no frame placement and can treat brain or spinal targets with submillimetric precision. This technique can be used to treat cervical or lumbar dorsal roots. A 44-year-old patient with von Hippel-Lindau disease developed severe spastic tetraparesis following multiple brain and

spinal procedures. Spasticity and related pain mostly affected the right leg, with sustained electromyographic discharges originating from the right L4 nerve root. Response to medical therapy with baclofen and cannabinoids was poor. Due to geographical and logistical issues, the patient declined the placement of an intrathecal baclofen pump. Considering the poor general condition of the patient and his decision to avoid invasive procedures, a novel treatment option was offered to provide relief from spasticity and pain: stereotactic image-guided irradiation delivered to the sensory root. The patient underwent a right intraforaminal dorsolateral L4 root stereotactic irradiation with a delivered dose of 45 Gy prescribed to the 82% isodose. The treatment was well tolerated, without side effects. Resolution of spasticity and related pain in the right leg was found six months after the procedure. A marked reduction of spasticity and pain was also evident in the contralateral leg. These improvements have been stable over the last 18 months. So far, two additional patients underwent stereotactic dorsolateral spinal root irradiation (one delivered to a cervical, the other to a lumbar), with similar positive outcomes. These preliminary results suggest that spinal root stereotactic image-guided irradiation, a novel treatment option in the neurosurgical armamentarium, is a safe and effective procedure and deserves further investigation.

PMID: [32617202](#)

3. Recurrent Internal Hip Rotation Gait in Cerebral Palsy: Case Reports of Two Patients

Rory O'Sullivan, Damien Kiernan

Case Reports HRB Open Res. 2019 Jan 29;1:28. doi: 10.12688/hrbopenres.12893.2. eCollection 2018.

Internal hip rotation in cerebral palsy (CP) is typically treated with a femoral derotation osteotomy. This has been shown to be largely a successful procedure but recurrence rates up to 41% have been reported. Reported risk factors include younger age, reduced hip joint impulse and ankle plantar-flexion. We report on two patients with bilateral CP demonstrating recurrent unilateral internal hip rotation despite surgical intervention(s). Both demonstrate a number of the reported risk factors for recurrence. In addition, this case report specifically compared gait kinematic patterns pre and post recurrence. On comparing both patient's hip rotation and ankle dorsi/plantarflexion kinematics they are seen to be almost identical both pre-operatively and post-operatively. Both patients appear to revert to approximately 30° of internal hip rotation which has been shown to maximise hip abductor function. Therefore, this case report suggests that surgical derotation in isolation is unlikely to be successful in this group and we suggest that this hip and ankle pattern may help predict recurrence in unilateral internal hip rotation.

PMID: [32596628](#)

4. The Effects of Serial Casting on Lower Limb Function for Children With Cerebral Palsy: A Systematic Review With Meta-Analysis

Nikki Milne, Michelle Miao, Emma Beattie

BMC Pediatr. 2020 Jul 2;20(1):324. doi: 10.1186/s12887-020-02122-9.

Background: Lower limb serial casting is commonly used therapeutically in paediatric clinical practice with some evidence to support its efficacy. This systematic review aimed to determine the effects of serial casting in isolation or combination with other therapies for the management of lower limb dysfunction in children with Cerebral Palsy (CP). **Methods:** A systematic literature search was conducted in February 2019 across eight databases (PUBMED, EMBASE, CINAHL, PEDro, OTSeeker, Cochrane, Scopus and Proquest) using key terms 'Cerebral Palsy' and 'serial casting' and associated synonyms. A meta-synthesis and meta-analysis were undertaken when sufficient results were available showing the effect of serial casting on functional outcomes including: Ankle range of motion; neurological measures of hypertonicity and spasticity, functional gait measures and; gross motor function. **Results:** Twenty-five articles from 3219 possible citations were included. Serial casting was found to be effective for: Improving ankle dorsiflexion (DF) passive range of motion (PROM) in the immediate to short-term, decreasing hypertonicity measured by Modified Ashworth Scale (MAS) in the short-term and, enhancing functional gait outcomes in the mid-term. Serial casting with or without botulinum toxin type-A (BTX-A) did not significantly affect gross motor capacity measured by Gross Motor Function Measure (GMFM). Serial casting with pharmacological intervention achieved significantly more DF PROM than serial casting alone (MD - 3.19 degrees; 95% CI - 5.76 to - 0.62; P = 0.01; I² = 0%), however the clinical importance of improving ankle DF PROM by an additional three degrees remains unclear. **Conclusions:** Lower limb serial casting, improves several outcomes relevant to lower limb function supporting its clinical use for improving DF PROM, reducing hypertonicity and improving gait in children with CP. Further research using stronger methodological study designs, is indicated to explore long-term effects of serial casting on functional lower limb outcomes such as gross motor function in children with CP. Clinicians can use this information when developing individualised treatment

plans for children who have CP during shared decision-making consultations.

PMID: [32615954](#)

5. Motion Analysis and Surgical Results of Anterior Transfer of Flexor Hallucis Longus for Equinovarus Gait in Children With Hemiplegia

Hiroki Fujita, Hiroyori Fusagawa, Hisato Nishibu, Toshiya Nosaka, Toshikatsu Matsuyama, Kousuke Iba, Toshihiko Yamashita

J Orthop Sci. 2020 Jun 26;S0949-2658(20)30139-1. doi: 10.1016/j.jos.2020.05.001. Online ahead of print.

Background: Rigid equinovarus foot deformities are seen in patients with cerebral palsy (CP). This retrospective study was undertaken to evaluate flexor hallucis longus tendon (FHL) transfer with gastrocnemius recession (GSR) using motion analyses and quantitative measurement, and to investigate postoperative complications. **Methods:** This study included 10 hemiplegic CP patients who underwent FHL transfer with GSR, and were evaluated by motion analyses consisting of weight distribution in static standing position and three-dimensional gait analysis, both pre and post-operatively. They were assessed in terms of kinematic data, Gait Variable Scores (GVS), and Gait Profile Score (GPS). **Results:** The mean age at operation was 7.3 years (range, 4-13 years), and mean follow-up duration was 35 months (range, 25-64 months) post-operatively. Weight distribution at surgical site significantly rose from 34.3% pre-operatively to 47.3% post-operatively, and abnormal asymmetry of weight distribution between surgical site and contralateral site disappeared post-operatively. Maximum ankle dorsiflexion (ADF) at initial contact rose from -20.9° to -6.28° . Similarly, Maximum ADF at both stance and swing phase rose from -13.8° to 17.7° ($P = 0.0003$), and from -19.5° to 1.35° ($P = 0.001$), respectively. Although mean GPS decreased from 15.6° pre-operatively to 11.8° , which corresponded to 2.38 times the minimal clinically important difference (MCID = 1.6°), three cases manifested talipes calcaneus at final follow-up. **Conclusion:** Although quantitative assessment showed that the potential value of FHL transfer with GSR was to obtain initial heel contact and maintain sufficient clearance from the ground in swing, it also revealed a risk of leading to talipes calcaneus. In the near future, we should establish accurate criteria for determination of transfer site, and consider the possibility of modification of this procedure in order to balance between recurrent equinus and significant talipes calcaneus. **Study design:** Clinical comparison between preoperative and postoperative.

PMID: [32600904](#)

6. Early Mobilization Rehabilitation Program for Children With Cerebral Palsy Undergoing Single-Event Multilevel Surgery

Melissa Howard, Christina Bickley, Judi Linton, Leah Northcutt, Melanie Lux, Allison Scott, Lindsay Stephenson, Douglas Barnes

Pediatr Phys Ther. 2020 Jul;32(3):218-224. doi: 10.1097/PEP.0000000000000709.

Purpose: This study investigates functional and technical outcomes to support an early mobilization approach to rehabilitation after single-event multilevel surgery (SEMLS) for children with cerebral palsy (CP), and disseminates innovative guidelines emphasizing early walking. **Methods:** Twenty-three participants with spastic diplegic CP ages 7 through 17 years, Gross Motor Function Classification System levels I to III, who underwent an early mobilization program after SEMLS were reviewed. Outcomes were examined from motion analysis data and clinical documentation. **Results:** All participants were able to return to school walking at discharge. At 1-year postoperatively, participants had returned to their prior walking level or better. Change in Gait Deviation Index and Pediatric Outcomes Data Collection Instrument indicated improvements in functional mobility and gait consistent with or greater than the literature. **Conclusion:** This intensive early mobilization program restores participation in daily activities, walking, and school within the first month postoperatively.

PMID: [32604364](#)

7. Commentary on "Early Mobilization Rehabilitation Program for Children With Cerebral Palsy Undergoing Single-Event Multilevel Surgery"

Brigid Griffin, Kelly Greve

Pediatr Phys Ther. 2020 Jul;32(3):225. doi: 10.1097/PEP.0000000000000716.

PMID: [32604365](#)

8. Orthopaedic Management of Knee Joint Impairment in Cerebral Palsy: A Systematic Review and Meta-Analysis

Ryan Campbell, Nicholas Tipping, Christopher Carty, John Walsh, Liam Johnson

Gait Posture. 2020 Jun 20;80:347-360. doi: 10.1016/j.gaitpost.2020.06.020. Online ahead of print.

Background: The optimal management of impaired knee joint function in patients with cerebral palsy (CP) remains a significant and ongoing challenge in paediatric orthopaedic surgery. **Research question:** What are the clinical and functional outcomes after operative and non-operative orthopaedic interventions for knee joint impairment in patients with CP? **Methods:** This systematic review and meta-analysis of orthopaedic interventions for the management of knee joint impairment in paediatric CP patients evaluated study-level data in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement. We performed searches of the following electronic databases from their dates of inception to November 2019: Medline (Ovid), Embase (Ovid) and Pubmed. We extracted mean differences in pre-operative and post-operative measurements for the following outcomes: minimum knee flexion in stance; knee flexion at initial contact; maximum knee flexion in swing; range of motion; popliteal angle; fixed flexion deformity angle; and mean pelvic tilt. **Results:** Sixty-nine retrospective cohort studies, prospective cohort studies and RCTs comprising 2991 patients were included with 4578 knees analysed. Included studies were of sufficient quality as assessed by the MOOSE checklist. Operative interventions showed significant improvement in knee flexion at initial contact, knee flexion in stance, range of motion, popliteal angle and fixed flexion deformity which were comparable when subgrouped according to operative technique. In contrast, non-operative techniques and botulinum toxin injection did not confer significant improvements. Operative interventions for knee joint impairment led to increased mean pelvic tilt and reduced maximum knee flexion in swing. **Significance:** This review provides strong evidence that operative interventions for the management of knee joint impairment in cerebral palsy patients improve knee kinematics and clinical examination findings.

PMID: [32615408](#)

9. Fatigue in Children and Young Adults With Physical Disabilities: Relation With Energy Demands of Walking and Physical Fitness

Eline A M Bolster, Astrid C J Balemans, Vincent de Groot, Annemieke I Buizer, Annet J Dallmeijer

Pediatr Phys Ther. 2020 Jul;32(3):202-209. doi: 10.1097/PEP.0000000000000705.

Purpose: To examine whether general fatigue and fatigue during or after walking are related to energy demands during walking and physical fitness in children and young adults with physical disabilities. **Methods:** Sixty-eight individuals with physical disabilities participated. General fatigue (Checklist Individual Strength [CIS8R] questionnaire), walking-induced fatigue (OMNI [OMNIwalk] scale after walking for 6 min), gross and net energy costs (ECs) of walking, physical strain of walking, and aerobic and anaerobic fitness were measured. **Results:** Regression analyses showed no relations with the CIS8R. For all participants, a higher net EC was weakly related to an increased OMNIwalk. For teenagers only, low anaerobic fitness and high physical strain of walking values were moderately related to high OMNIwalk scores. **Conclusion:** Low anaerobic fitness and high physical strain values partly explain fatigue after walking in teenagers with cerebral palsy, but not in younger children. General fatigue was not explained by low fitness levels or high energy demands of walking.

PMID: [32604360](#)

10. Effect of RaceRunning on Cardiometabolic Disease Risk Factors and Functional Mobility in Young People With Moderate-To-Severe Cerebral Palsy: Protocol for a Feasibility Study

Jennifer Ryan, Nicola Theis, Pelagia Koufaki, Shaun Phillips, Nana Anokye, Georgia Andreopoulou, Fiona Kennedy, Kavi C Jagadamma, Petra vanSchie, Hannah Dines, Marietta L van der Linden

BMJ Open. 2020 Jul 1;10(7):e036469. doi: 10.1136/bmjopen-2019-036469.

Introduction: There is consistent evidence that people with cerebral palsy (CP) do not engage in the recommended physical activity guidelines for the general population from a young age. Participation in moderate-to-vigorous physical activity is particularly reduced in people with CP who have a moderate-to-severe disability. RaceRunning is a growing disability sport that provides an opportunity for people with moderate-to-severe disability to participate in physical activity in the community. It allows those who are unable to walk independently to propel themselves using a RaceRunning bike, which has a breastplate for support but no pedals. The aim of this study is to examine the feasibility and acceptability of RaceRunning for young people with moderate-to-severe CP and the feasibility of conducting a definitive study of the effect of RaceRunning on cardiometabolic disease risk factors and functional mobility. **Methods and analysis:** Twenty-five young people (age 5-21 years) with CP or acquired brain injury affecting coordination will be included in this single-arm intervention study. Participants will take part in one RaceRunning session each week for 24 weeks. Outcomes assessed at baseline, 12 and 24 weeks include body mass index, waist circumference, blood pressure, muscle strength, cardiorespiratory fitness, physical activity and sedentary behaviour, functional mobility, activity competence and psychosocial impact. Adverse events will be systematically recorded throughout the 24 weeks. Focus groups will be conducted with participants and/or parents to explore their views and experiences of taking part in RaceRunning. **Ethics and dissemination:** Approval has been granted by Queen Margaret University Research Ethics Committee (REC) and the South East of Scotland REC. Results will be disseminated through peer-reviewed journals and distributed to people with CP and their families through RaceRunning and Athletic Clubs, National Health Service trusts and organisations for people with disabilities. Trial registration number: NCT04034342; pre-results.

PMID: [32611743](#)

11. SPORTS STARS: A Practitioner-Led, Peer-Group Sports Intervention for Ambulant Children With Cerebral Palsy. Activity and Participation Outcomes of a Randomised Controlled Trial

Georgina L Clutterbuck, Megan L Auld, Leanne M Johnston

Disabil Rehabil. 2020 Jun 30;1-9. doi: 10.1080/09638288.2020.1783376. Online ahead of print.

Purpose: To investigate the effectiveness of a practitioner-led, peer-group sports intervention for children with CP at GMFCS Level I-II. **Method:** Children with CP (GMFCS I-II; 6-12 years) were randomised to Sports Stars or waitlist-control groups. Sports Stars included eight-weeks (eight hours) of physiotherapist-led, sports-specific gross motor activity training, sports education, teamwork development and confidence building. Sports participation was measured using self-identified participation goals (modified Canadian Occupational Performance Measure (mCOPM)). Physical competence was measured with mCOPM activity goals and high-level gross motor batteries (Test of Gross Motor Development (TGMD-2); GMFM-Challenge) and walking (Timed-Up-and-Go), running (Muscle Power Sprint Test; 10x5m Sprint Test), jumping (Standing Broad Jump; Vertical Jump) and throwing (Seated Throw) items. General participation and quality of life were also measured. Outcomes were measured pre, post and 12-weeks post-intervention. Data were analysed using linear mixed models. **Results:** Fifty-four children were randomised into Sports Stars (n = 29; GMFCS I = 7, II = 22; male = 19; 8.9 ± 2 years) or waitlist-control groups (n = 25; GMFCS I = 10, II = 15; male = 14; 8.6 ± 2 years). The Sports Stars group improved sports participation and activity goals (mCOPM F = 5.49-10.29, p < 0.001) and sports-specific physical competence (TGMD-2, F = 3.45-5.19, p = 0.001-0.009) compared to the waitlist-control. **Conclusion:** Sports Stars is effective for improving sports-specific participation and physical competence for children with CP. **Implications for rehabilitation** Sports Stars improves performance and satisfaction in sports-specific participation and activity goals for ambulant children with CP. Sports Stars improves sports-specific physical activity competence in locomotor and object control skills. Sport-specific interventions should incorporate sport-specific gross motor activity training as well as sports education, confidence building and teamwork.

PMID: [32603238](#)

12. Pain Assessment in Cerebral Palsy: A Systematic Review of Measurement Properties and Evaluation Using the COSMIN Checklist

Hilma Caravau, Ana Filipa Rosa, Nelson P Rocha, Anabela G Silva

Disabil Rehabil. 2020 Jul 3;1-11. doi: 10.1080/09638288.2020.1783000. Online ahead of print.

Purpose: This systematic literature review aims to analyse the methodological quality of instruments available to assess pain in Cerebral Palsy (CP), according to the COSMIN guidelines and checklist. **Materials and methods:** Electronic literature searches were conducted in PubMed, ScienceDirect, Web of Science, PEDro, Scielo, Scopus and Academic Search Complete (EBSCO host) for articles on measurement properties of self-report, proxy or observational instruments. **Results:** A total of 14 instruments were identified. Of these, 8 were self-report instruments, 4 were observational instruments and 2 could be used both as self-report or proxy-report. The quality of the manuscripts was inadequate or doubtful in 45.5%, adequate in 15.9% and very good in 38.6% of the cases. No instrument was assessed for all the properties recommended by COSMIN. The quality of the evidence for the measurement properties of the pain assessment instruments ranged from very low to moderate. **Conclusions:** There is scarce and low-quality evidence on the measurement properties of instruments used to assess pain in individuals with cerebral palsy. Further research is needed designed in line with the COSMIN recommendations. **Implications for rehabilitation** There is scarce and low-quality evidence on the measurement properties of instruments used to assess pain in individuals with cerebral palsy; Clinicians need to carefully choose instruments to assess pain in individuals with cerebral palsy as there is insufficient evidence on the quality of instruments; Self-report pain intensity scales may be a useful instrument for a subgroup of individuals with cerebral palsy.

PMID: [32619368](#)

13. What Is the Effectiveness and Safety of Different Interventions in the Management of Drooling in Children With Cerebral Palsy?

Sujata Khajuria, Khuen Foong Ng, Rosalind J Jefferson

Arch Dis Child. 2020 Jun 30;archdischild-2020-319309. doi: 10.1136/archdischild-2020-319309. Online ahead of print.

PMID: [32606035](#)

14. [Consensus on Nutritional Support for Children With Cerebral Palsy] [Article in Chinese]

Subspecialty Group of Rehabilitation, the Society of Pediatrics, Chinese Medical Association;; Subspecialty Group of Pediatrics, the Society of Parenteral and Enteral Nutrition, Chinese Medical Association

Zhonghua Er Ke Za Zhi. 2020 Jul 2;58(7):553-558. doi: 10.3760/cma.j.cn112140-20200425-00431.

PMID: [32605338](#)

15. Pausing and Sentence Stress in Children With Dysarthria Due to Cerebral Palsy

Anja Kuschmann, Anja Lowit

Folia Phoniater Logop. 2020 Jun 30;1-10. doi: 10.1159/000508097. Online ahead of print.

Introduction: Children with dysarthria due to cerebral palsy (CP) can experience problems manipulating intensity, fundamental frequency, and duration to signal sentence stress in an utterance. Pauses have been identified as a potential additional cue for stress-marking, which could compensate for this deficit. **Objective:** This study aimed to determine whether children use pauses to signal stress placement, and whether this differs between typically developing children and those with CP. **Methods:** Six children with CP and 8 typically developing children produced utterances with stresses on target words in 2 different positions. Pauses before and after the stressed target words were analyzed in terms of number, location, and duration. **Results:** Both groups inserted pauses into their utterances. However, neither group used pause location or duration in a systematic manner to signal the position of the words stressed. **Conclusions:** The results suggest that pausing was not used strategically by either group to signal sentence stress. Further research is necessary to explore the value of pausing as a cue to stress-marking in general and as a potential compensatory strategy for speakers with dysarthria.

PMID: [32604092](#)

16. The Pediatric Subjective Global Nutrition Assessment Classifies More Children With Cerebral Palsy as Malnourished Compared With Anthropometry

Kristie L Bell, Katherine A Benfer, Robert S Ware, Tania A Patrao, Josephine J Garvey, Rachel Haddow, Roslyn N Boyd, Peter S W Davies, Joan C Arvedson, Kelly A Weir

J Acad Nutr Diet. 2020 Jun 24;S2212-2672(20)30347-6. doi: 10.1016/j.jand.2020.04.012. Online ahead of print.

Background: Nutrition assessment is multidimensional; however, much of the literature examining the nutritional status of children with cerebral palsy (CP) focuses on a single dimension. **Objective:** The aim of the study was to evaluate nutritional status in children and adolescents with CP by comparing results from the Pediatric Subjective Global Nutrition Assessment (SGNA) with results from traditional anthropometric measures. **Design:** This study was a cross-sectional observational study. **Participants/setting:** This study was conducted in a tertiary hospital outpatient setting in Brisbane, Australia, from February 2017 to March 2018. A total of 89 children (63 boys) with CP aged between 2 and 18 years of age were included. All Gross Motor Function Classification System levels were observed. The majority of children were in Gross Motor Function Classification System I and II (57, 64%) compared with Gross Motor Function Classification System III to V (32, 36%). Children with feeding tubes and those acutely unwell or hospitalized were excluded. **Main outcome measures:** Children were classified as well nourished, moderately malnourished, or severely malnourished by dietitians using the SGNA. Weight, height, body mass index (BMI), triceps skinfold thickness, subscapular skinfold thickness, and mid upper arm circumference were measured and converted to z scores to account for age and sex differences. Moderate malnutrition was defined by z scores -2.00 to -2.99 and severe malnutrition as ≤ -3.00 z scores. **Statistical analysis performed:** Multinomial logistic analyses were used to compare results from the SGNA and each single measurement. Continuous outcomes were transformed into z scores. Agreement was assessed with 2 categories: not malnourished and malnourished. Comparison statistics included percent agreement, sensitivity, and specificity. **Results:** More children were classified as moderately or severely malnourished by SGNA than any of the anthropometric z score cutoffs. The majority of children were well nourished (n = 63) with 20 (22%) moderately malnourished and 6 (7%) severely malnourished by SGNA. The SGNA classified 11 children as malnourished that were not classified as malnourished by BMI. Children with moderate or severe malnutrition by SGNA had lower weight (P < .001, P < .001), BMI (P < .001, P < .001), mid upper arm circumference (P < .001, P < .001), triceps skinfold thickness (P = .01, P = .007), and subscapular skinfold thickness (P = .005, P = .02) z scores than well-nourished children. **Conclusion:** The SGNA identified more potentially malnourished children including children classified as well nourished by the single measurements such as BMI, height, and weight. The SGNA provided a clinically useful multidimensional approach to nutrition assessment for children with CP.

PMID: [32593667](#)

17. Beyond the Eye: Cortical Differences in Primary Visual Processing in Children With Cerebral Palsy

Jacy R VerMaas, Christine M Embury, Rashelle M Hoffman, Michael P Trevarrow, Tony W Wilson, Max J Kurz

Neuroimage Clin. 2020 Jun 19;27:102318. doi: 10.1016/j.nicl.2020.102318. Online ahead of print.

Despite the growing clinical recognition of visual impairments among people with cerebral palsy (CP), very few studies have evaluated the neurophysiology of the visual circuitry. To this end, the primary aim of this investigation was to use magnetoencephalography and beamforming methods to image the relative change in the alpha-beta and gamma occipital cortical oscillations induced by a spatial grating stimulus (e.g., visual contrast) that was viewed by a cohort of children with CP and typically-developing (TD) children. Our results showed that the high-contrast, visual gratings stimuli induced a decrease in alpha-beta (10 - 20 Hz) activity, and an increase in both low (40 - 56 Hz) and high (60 - 72 Hz) gamma oscillations in the occipital cortices. Compared with the TD children, the strength of the frequency specific cortical oscillations were significantly weaker in the children with CP, suggesting that they had deficient processing of the contrast stimulus. Although CP is largely perceived as a musculoskeletal centric disorder, our results fuel the growing impression that there may also be prominent visual processing deficiencies. These visual processing deficits likely impact the ability to perceive visual changes in the environment.

PMID: [32604019](#)

18. The Effect of a Rehabilitation Specific Gaming Software Platform to Achieve Individual Physiotherapy Goals in Children With Severe Spastic Cerebral Palsy: A Randomized Crossover Trial

Sophie Decavele, Els Ortibus, Anja Van Campenhout, Guy Molenaers, Bart Jansen, Lubos Omelina, Inge Franki

Games Health J. 2020 Jul 2. doi: 10.1089/g4h.2019.0097. Online ahead of print.

Cerebral palsy (CP) is the most common cause of permanent neurological disabilities in children. Many children require long-term daily physiotherapy (PT), and videogaming is a promising tool to increase motivation in rehabilitation. The short- and medium-term effects of an intervention with rehabilitation specific videogames were evaluated on individually defined therapy goals, gross motor function, and motivation. Thirty-two children with bilateral spastic CP, Gross Motor Function Classification level III-IV, and 6-15 years were randomized into an intervention group (regular PT and gaming) or a control group (regular PT), followed by a crossover. The effects of both training periods (each 12 weeks) were compared using the Goal Attainment Scale (GAS), Trunk Control Measurement Scale (TCMS), Pediatric Balance Scale (PBS), Gross Motor Function Measure-88 (GMFM-88), and Dimensions of Mastery Motivation Questionnaire (DMQ). After 3 months follow-up, children were retested using the GMFM, TCMS, and PBS. The GAS change scores were significantly higher after the intervention compared to the control period (8.5 and 2.4, $P < 0.001$). The change scores for standing exercises (3.85 and 0.22, $P = 0.04$) and dynamic sitting balance (5.9 and -1.7, $P < 0.001$) were also significantly higher. After 3 months follow-up the results did not persist. A combined approach of regular PT and rehabilitation specific gaming showed significant effects on individually defined therapy goals, dynamic sitting balance, and standing exercises. However, the lack of persistent effect indicates that continuous individual goal-oriented PT with the addition of gaming is needed.

PMID: [32614723](#)

19. Beginning Power Mobility: An Exploration of Factors Associated With Child Use of Early Power Mobility Devices and Parent Device Preference

Roslyn W Livingstone, Jeffrey Bone, Debra A Field

J Rehabil Assist Technol Eng. 2020 Jun 17;7:2055668320926046. doi: 10.1177/2055668320926046. eCollection Jan-Dec 2020.

Objectives: Describe and compare young children's use of four early power mobility devices and examine associations between child and environmental factors that may influence power mobility use and parent device preference. Design: Cross-sectional observational study. Methods: Power Mobility Days introduced four devices: Wizzybug, Bugzi, Tiger Cub, and a switch-adapted ride-on toy car in a single 60-90 min, play-based session. Results: A convenience sample of 74 children, aged 9-68 months (mean: 32.45, SD: 14.08) with mobility limitations, and their parents participated. Children had a range of motor, postural and communication profiles, with cerebral palsy being the most common condition ($n = 55$; 73.33%). Assessment of Learning Powered mobility use phase achieved ranged from 1 to 6; mean: 2.34; median: 2. For children who tried all four devices ($n = 51$), Friedman test ($\chi^2: 8.27$, $p = 0.04$) suggests Assessment of Learning Powered mobility use phase differs across devices. Of 73 parents who identified a device preference, 43 (59%) chose Wizzybug. Regression analyses suggest that access method and communication function may influence children's power mobility use, while age, access and postural support requirements may influence parent device choice. Discussion: Parent impressions of an early power mobility device may be influenced by many factors, yet be less influenced by child performance.

PMID: [32595979](#)

20. The Australian & New Zealand Cerebral Palsy Strategy

Nadia Badawi, Ingrid Honan, Megan Finch-Edmondson, Amy Hogan, Jennifer Fitzgerald, Christine Imms

Editorial Dev Med Child Neurol. 2020 Aug;62(8):885. doi: 10.1111/dmcn.14554.

PMID: [32608508](#)

21. Cerebral Palsy: Current Opinions on Definition, Epidemiology, Risk Factors, Classification and Treatment Options

Małgorzata Sadowska, Beata Sarecka-Hujar, Iłona Kopyta

Review Neuropsychiatr Dis Treat. 2020 Jun 12;16:1505-1518. doi: 10.2147/NDT.S235165. eCollection 2020.

Cerebral palsy (CP) is one of the most frequent causes of motor disability in children. According to the up-to-date definition, CP is a group of permanent disorders of the development of movement and posture, causing activity limitations that are attributed to non-progressive disturbances that occurred in the developing foetal or infant brain. The CP definition has evolved over time; the problem is aetiologically and clinically very heterogeneous. According to European data, the average frequency of CP is 2.08 per 1000 live births, but in the group of children born with a body weight below 1500 g, the frequency is 70 times higher when compared with the group of children with a body weight over 2500 g at birth. The risk factors for CP can be divided into pre-conception, prenatal, perinatal and postnatal ones. CP commonly co-exists with epilepsy, in particular drug-resistant epilepsy, but also with mental retardation, visual and hearing impairment, as well as feeding and behavioral disorders. The degree of motor problem varies from mild to very severe making the child totally dependent on caregivers. Cerebral palsy is divided into forms depending on the type of motor disorders which dominate the clinical presentation; the traditional classifications by Ingram and Hagberg have now been replaced by the Surveillance of Cerebral Palsy in Europe classification which divides CP into spastic, dyskinetic and ataxic forms. Although cerebral palsy is a clinical diagnosis, modern diagnostic imaging provides information that allows the division of the results of magnetic resonance imaging in children with cerebral palsy into five groups according to the magnetic resonance imaging classification system. Just as the clinical presentation and the factors predisposing for CP are very diverse, treatment is also a very complex problem. Modern treatment of spasticity includes both botulinum toxin therapies and surgical techniques, eg, rhizotomy. The authors present current views on definitions, risk factors, diagnostics and treatment of CP as well as comorbid problems, eg, drug-resistant epilepsy.

PMID: [32606703](#)

22. The Ecological-Enactive Model of Disability: Why Disability Does Not Entail Pathological Embodiment

Juan Toro, Julian Kiverstein, Erik Rietveld

Front Psychol. 2020 Jun 11;11:1162. doi: 10.3389/fpsyg.2020.01162. eCollection 2020.

In the last 50 years, discussions of how to understand disability have been dominated by the medical and social models. Paradoxically, both models overlook the disabled person's experience of the lived body, thus reducing the body of the disabled person to a physiological body. In this article we introduce what we call the Ecological-Enactive (EE) model of disability. The EE-model combines ideas from enactive cognitive science and ecological psychology with the aim of doing justice simultaneously to the lived experience of being disabled, and the physiological dimensions of disability. More specifically, we put the EE model to work to disentangle the concepts of disability and pathology. We locate the difference between pathological and normal forms of embodiment in the person's capacity to adapt to changes in the environment. To ensure that our discussion remains in contact with lived experience, we draw upon phenomenological interviews we have carried out with people with Cerebral Palsy.

PMID: [32595560](#)

23. Parental Perspectives on Quality of Life in Adolescents With Cerebral Palsy

Prabhu Prajakta, Sunila John, Rajashekhar Bellur

Indian J Psychol Med. 2020 Apr 25;42(3):256-261. doi: 10.4103/IJPSYM.IJPSYM_300_19. eCollection May-Jun 2020.

Background: Quality of life (QoL) is an important outcome variable while evaluating intervention effectiveness during adolescence. Limited studies have addressed the issues that affect the QoL in adolescents with cerebral palsy. The present study explores the parent-reported QoL in adolescents with cerebral palsy. **Materials and methods:** Using a cross-sectional study design, parental perspectives on QoL were investigated among 35 parents of adolescents with cerebral palsy, aged between 13 and 18 years. Performance on seven domains of QoL across age and gender were explored. **Results:** While the maximum QoL was seen in the domain of social well-being, the least QoL was noted for feelings about functioning. Across age, the early adolescence group (13-15 years) had a poorer quality of life in comparison to the late adolescence group (16-18 years). With respect to the gender, though females had a lower QoL scores, a statistically significant difference was observed only for the domain of general well-being and participation. **Conclusions:** From a parental perspective, the major issues of concern in adolescents with cerebral palsy were feelings about functioning, general well-being and participation, and access to services. This information will be useful when establishing management options or assessment protocols to improve their overall QoL.

PMID: [32612330](#)

24. Quality of Life of Adolescents With Cerebral Palsy: Agreement Between Self-Report and Caregiver's Report [Article in English, Portuguese, Spanish]

Mariana Ceravolo Ferreira, Nathália Ribeiro Garcia, Cejane Oliveira Martins Prudente, Maysa Ferreira Martins Ribeiro

Rev Lat Am Enfermagem. 2020 Jul 1;28:e3300. doi: 10.1590/1518-8345.3928.3300. eCollection 2020.

Method: to assess the quality of life (QOL) of adolescents with cerebral palsy (CP) by self-report and by the caregiver's report, and to analyze the agreement between these reports. cross-sectional study conducted with 101 adolescents with CP and 101 caregivers. Both answered the Pediatric Quality of Life Inventory (PedsQL), module 4.0 - Generic (PedsQL 4.0) and module 3.0 - PC (PedsQL 3.0). Agreement between reports was analyzed using the Mann-Whitney test and the intra-class correlation coefficient (ICC) ($p < 0.05$). Results: the lowest scores were in physical health, school activities and fatigue in the self-report. The lowest scores were in physical health and daily activities, in the caregivers' report. Perceptions among adolescents and caregivers differed in physical health, movement and equilibrium, daily and school activities, with a lower score for caregivers in all of them. The agreement between the self-report and the caregivers' report was poor ($ICC < 0.44$) and in both instruments, the caregivers' report was less optimistic. Conclusion: physical health is the most impaired domain of the QOL of adolescents with CP, both in the self-report and in the caregivers' report. However, there is poor agreement between these reports, emphasizing that the use of the caregivers' report should be cautious.

PMID: [32609264](#)

25. I Want to Play: Children With Cerebral Palsy Talk About Their Experiences on Barriers and Facilitators to Participation in Leisure Activities

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Pediatr Phys Ther. 2020 Jul;32(3):190-200. doi: 10.1097/PEP.0000000000000719.

Purpose: To explore how children with cerebral palsy (CP) experience participation in leisure activities and to describe the environmental barriers and facilitators. Methods: Sixteen children with cerebral palsy aged 7 to 17 years participated in 3 focus groups. Data were analyzed thematically by 3 researchers on the basis of the International Classification of Functioning, Disability and Health. Results: A total of 38 International Classification of Functioning, Disability and Health categories were identified (4 linked to Body functions; 2 linked to Body structures; 8 linked to Activities & Participation, and 24 to Environmental factors: 10 facilitators and 14 barriers). The most mentioned categories were Voluntary movement control functions, Functions related to gait pattern, Structure of upper arm, Recreation and leisure, Nuclear family and finally, and Individual attitudes of acquaintances. Conclusions: The main barriers identified by children with cerebral palsy highlight aspects of the physical, social, and attitudinal environment that could be modified to enhance participation in leisure activities.

PMID: [32604358](#)

26. Commentary on "I Want to Play: Children With Cerebral Palsy Talk About Their Experiences on Barriers and Facilitators to Participation in Leisure Activities"

Maria A Fragala-Pinkham, Margaret E O'Neil

Pediatr Phys Ther. 2020 Jul;32(3):201. doi: 10.1097/PEP.0000000000000724.

PMID: [32604359](#)

27. Identifying Cerebral Palsy Phenotypes Objectively

Alan Leviton

Dev Med Child Neurol. 2020 Jun 29. doi: 10.1111/dmcn.14604. Online ahead of print.

PMID: [32597500](#)**28. Do Infants at Risk of Developing Cerebral Palsy or Other Neurodevelopmental Disorders Learn What They Practice?**

Kristina Löwing, Linda Holmström, Rita Almeida, Ann-Christin Eliasson

J Clin Med. 2020 Jun 29;9(7):E2041. doi: 10.3390/jcm9072041.

Through secondary analyses of the Small Step. Randomized Control Trial, we tested the hypothesis that children at risk of developing cerebral palsy (CP) or other neurodevelopmental disorders would learn what they practice, i.e., that they would have a more rapid development within the specifically trained foci (hand use or mobility) of each time period compared to the development rate within the foci not trained at that time. Nineteen infants (6.3 (1.62) months corrected age) included in the Small Step program were assessed at six time points during the intervention. For statistical analysis, general and mixed linear models were used, and the independent variables were the Peabody Developmental Motor scale (stationary, locomotion, grasping and visuomotor sub scales), the Gross Motor Function Measure-66 and the Hand Assessment for Infants. Outcomes related to gross motor function improved significantly more after mobility training than after hand use training, while fine motor function was improved to the same extent following both training types. Significantly higher improvements after the first training period were seen in one out of three outcome measures in both gross and fine motor assessments. The improvements observed were all independent of diagnosis at two years. The concept "you learn what you practice" was most clearly confirmed in the case of gross motor development.

PMID: [32610634](#)**29. A Child With a Novel DDX3X Variant Mimicking Cerebral Palsy: A Case Report**

Liqin Hu, Xiaoqin Xin, Shaobin Lin, Min Luo, Junkun Chen, Hongsheng Qiu, Li Ma, Jungao Huang

Ital J Pediatr. 2020 Jun 29;46(1):88. doi: 10.1186/s13052-020-00850-3.

Background: Cerebral palsy (CP) is a non-progressive disorder of movement and posture due to a static insult to the brain. In CP, the depth of investigation is guided by the patients' medical history and their clinical examination. Magnetic resonance imaging (MRI) has a high yield and is widely used for investigation in CP. Case presentation: In this paper, we report a novel DDX3X variant in a girl afflicted with the X-linked mental retardation-102 (MRX102). The girl had been misdiagnosed with CP in her early life based on a comprehensive clinical evaluation and associated clinical features, such as developmental delay, reduced activities of the arms and legs, and abnormal brain MRI. Subsequently, whole-exome sequencing was applied to better distinguish between CP and actual MRX102 with similar characteristics. Conclusions: We report on a de novo heterozygous DDX3X variant mimicking cerebral palsy and suggest a thorough and conscientious review during diagnosis of CP.

PMID: [32600431](#)**30. Neural and Non-Neural Contributions to Enhanced Joint Stiffness in Children With Cerebral Palsy**

Carel Gm Meskers, Gert Kwakkel

Dev Med Child Neurol. 2020 Jun 30. doi: 10.1111/dmcn.14608. Online ahead of print.

PMID: [32602560](#)

31. Transcatheter Aortic Valve Replacement for Bicuspid Aortic Valve Regurgitation in a 17-year-old Patient With Congenitally Corrected Transposition of Great Arteries: A Case Report

Takahiro Nomura, Masaki Miyasaka, Evan M Zahn, Raj R Makkar

Case Reports Eur Heart J Case Rep. 2020 May 8;4(3):1-6. doi: 10.1093/ehjcr/ytaa102. eCollection 2020 Jun.

Background: Limited research has been conducted on the surgical management of the aortic valve in congenitally corrected transposition of great arteries (ccTGA) and to our knowledge there have been no reports on the treatment of bicuspid aortic regurgitation (AR) in ccTGA. We report on a ccTGA patient with bicuspid AR and systemic right ventricle (SRV) dysfunction who underwent transcatheter aortic valve replacement (TAVR). **Case summary:** A 17-year-old male with a history of ccTGA and cerebral palsy diagnosed at birth presented with heart failure. During childhood, he did not experience any heart failure symptoms, however, secondary to progressive bicuspid AR he experienced worsening SRV dysfunction beginning at 15-year-old. Echocardiography showed reduced SRV ejection fraction and severe bicuspid AR. The heart team, including a cardiac surgeon and paediatric cardiologist, discussed the treatment strategies and decided to proceed with TAVR as surgical aortic valve replacement was deemed high risk. TAVR was performed with the 34 mm Evolut R (Medtronic, Minneapolis, MN, USA). Post-operative echocardiography showed severe paravalvular leak (PVL). Therefore, valve-in-valve TAVR using a 29 mm Edwards SAPIEN 3 (Edwards Lifesciences, Irvine, CA, USA) was performed on post-operative Day 2 for PVL reduction. Following second procedure, PVL was significantly improved. The patient was discharged in stable condition. **Discussion:** This is the first case wherein TAVR was performed for bicuspid AR in a patient with ccTGA. With appropriate preparation and planning and a collaborative multi-disciplinary team approach, TAVR can be a treatment option for severe AR in patients with ccTGA at high risk for surgery.

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