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Interventions and Management

1. Measuring changes of manual ability with ABILHAND-Kids following intensive training for children with unilateral cerebral palsy.

Bleyenheuft Y, Gordon AM, Rameckers E, Thonnard JL, Arnould C.

Dev Med Child Neurol. 2016 Nov 29. doi: 10.1111/dmcn.13338. [Epub ahead of print]

ABILHAND-Kids is a parent-reported questionnaire measuring manual ability in children with cerebral palsy (CP). Its psychometric properties have been established, with the exception of responsiveness, which is examined here. In this cohort study, 98 children (46 males, 52 females; range 6-19y, mean 11y, standard deviation [SD] 3.3y) with unilateral CP underwent three assessments of upper extremity function: at baseline (T1); after 80 to 90 hours of intensive training (T2); and at follow-up (T3). The responsiveness was analyzed using global, group (based on age and on Manual Ability Classification System [MACS] level), and individual approaches during two time periods (T1-T2 and T2-T3). Effect size was used to quantify magnitude of changes. The global approach showed significant improvements between T1 and T2 ($p < 0.001$) but not between T2 and T3 ($p = 0.222$). In the group analyses, effect size and SRM demonstrated large changes in younger children (6-12y, $n = 52$, mean change = 1.06 logit, effect size > 0.8) and small changes in the older children (13-19y, $n = 46$, mean change = 0.71 logit, effect size > 0.4). Children in MACS level II demonstrated larger changes than children in MACS level I or III. The ABILHAND-Kids exhibited responsiveness in detecting changes after intensive training. Therefore, this scale is potentially useful in assessing the functional status of children with unilateral CP in clinical trials.

[PMID: 27896811](#)

2. Total Wrist Arthrodesis: Indications and Clinical Outcomes.

Wei DH, Feldon P.

J Am Acad Orthop Surg. 2016 Nov 22. [Epub ahead of print]

Total wrist arthrodesis remains an important technique in the surgical armamentarium of upper extremity surgeons. The procedure has evolved over time but continues to provide reliable pain relief at the expense of wrist motion. It is indicated for management of a wide variety of upper extremity conditions, including rheumatoid arthritis, posttraumatic osteoarthritis, cerebral palsy, and brachial plexus injuries, and as a salvage technique after failed implant arthroplasty. Recent studies demonstrate high levels of patient satisfaction and good functional outcomes after bilateral wrist fusion. Compared with total wrist arthroplasty, total wrist arthrodesis provides more reliable pain relief with lower rates of complications, but further studies are needed to compare functional outcomes and cost-effectiveness.

[PMID: 27893490](#)

3. The Mirror Illusion Increases Motor Cortex Excitability in Children With and Without Hemiparesis.

Grunt S, Newman CJ, Saxer S, Steinlin M, Weisstanner C, Kaelin-Lang A.

Neurorehabil Neural Repair. 2016 Nov 30. pii: 1545968316680483. [Epub ahead of print]

Background Mirror therapy provides a visual illusion of a normal moving limb by using the mirror reflection of the unaffected arm instead of viewing the paretic limb and is used in rehabilitation to improve hand function. Little is known about the mechanism underlying its effect in children with hemiparesis. Objective: To investigate the effect of the mirror illusion (MI) on the excitability of the primary motor cortex (M1) in children and adolescents. Methods Twelve patients with hemiparesis (10-20 years) and 8 typically developing subjects (8-17 years) participated. Corticospinal reorganization was classified as contralateral (projection from contralateral hemisphere to affected hand) or ipsilateral (projection from ipsilateral hemisphere to affected hand). M1 excitability of the hemisphere projecting to the affected (nondominant in typically developing subjects) hand was obtained during 2 different conditions using single-pulse transcranial magnetic stimulation (TMS). Each condition (without/with mirror) consisted of a unimanual and a bimanual task. Motor-evoked potentials (MEPs) were recorded from the abductor pollicis brevis and flexor digitorum superficialis muscles. Results MEP amplitudes were significantly increased during the mirror condition ($P = .005$) in typically developing subjects and in patients with contralateral reorganization. No significant effect of MI was found in subjects with ipsilateral reorganization. MI increased M1 excitability during active movements only. This increase was not correlated to hand function. Conclusion MI increases the excitability of M1 in hemiparetic patients with contralateral corticospinal organization and in typically developing subjects. This finding provides neurophysiological evidence supporting the application of mirror therapy in selected children and adolescents with hemiparesis.

[PMID: 27909072](#)

4. Structured skill practice during intensive bimanual training leads to better trunk and arm control than unstructured practice in children with unilateral spastic cerebral palsy.

Hung YC, Brandão MB, Gordon AM.

Res Dev Disabil. 2016 Nov 29;60:65-76. doi: 10.1016/j.ridd.2016.11.012. [Epub ahead of print]

Recently, intensive practice showed good efficacy in improving upper extremity function for children with unilateral spastic cerebral palsy (USCP). However, little is known about the significance of skill progression frequently used during intensive practice. We evaluate the importance of skill progression during intensive bimanual practice on movement coordination. Twenty children with USCP (average age: 8.5; MACS levels: I-III) participated in the study. Ten children were randomly allocated to a structured practice group (SPG) with skill progression, and the other 10 children randomized to an unstructured practice group (UPG) without skill progression. Both groups practiced bimanual activities 6h a day for 15days. Children were asked to perform a bimanual drawer-opening task before and after intensive practice using 3-D kinematic analyses. Both groups showed improved temporal bimanual coordination with increased normalized movement overlap of the two hands ($p=0.005$) and decreased goal synchronization time ($p=0.002$). However, only the SPG showed decreased trunk involvement ($p=0.01$) and increased elbow joint excursion ($p=0.017$) with decreased variability ($p=0.015$ and 0.048 respectively). The results highlighted the importance of skill progression for intensive practice to improve upper extremity and trunk movement control and consistency for children with USCP.

[PMID: 27912104](#)

5. Effect of selective dorsal rhizotomy on daily care and comfort in non-walking children and adolescents with severe spasticity.

Buizer AI, van Schie PE, Bolster EA, van Ouwkerk WJ, Strijers RL, van de Pol LA, Stadhouders A, Becher JG, Vermeulen RJ.

Eur J Paediatr Neurol. 2016 Oct 22. pii: S1090-3798(16)30185-4. doi: 10.1016/j.ejpn.2016.09.006. [Epub ahead of print]

In non-walking children with severe spasticity, daily care can be difficult and many patients suffer from pain. Selective dorsal rhizotomy (SDR) reduces spasticity in the legs, and therefore has the potential to improve daily care and comfort. To examine effects of SDR on daily care and comfort in non-walking children with severe spasticity due to different underlying neurological conditions. Associated orthopaedic problems were frequent. Seven patients underwent scoliosis correction in the same session. Most improvements were reported in dressing ($n = 16$), washing ($n = 12$) and comfort ($n = 10$). Median score for satisfaction was 7 on a scale of 10 (range 1-9).

SDR resulted in reduction of spasticity in leg muscles. In nine patients dystonia was recorded post-operatively, mainly in children with congenital malformations and syndromes. SDR is a single event intervention that can improve daily care and comfort in non-walking children with severe spasticity, and can safely be combined with scoliosis correction. Despite the improvements, satisfaction is variable. Careful attention is necessary for risk factors for dystonia, which may be unmasked after SDR.

[PMID: 27908676](#)

6. Intrathecal Baclofen Therapy for the Treatment of Spasticity in Lithuania.

Kvascevicus R, Lapteva O, Kesiene J, Vaitkus A, Mikulenaite L, Raugalas R, Sipylaite J, Rocka S, Juocevicus A.

J Neurol Surg A Cent Eur Neurosurg. 2016 Nov 30. [Epub ahead of print]

Spasticity of cerebral or spinal origin severely impairs an individual's functional ability and quality of life. Intrathecal baclofen (ITB) therapy via an implantable pump is indicated for use in patients unresponsive to oral antispasmodics. ITB therapy improves the daily caring for and relief of painful spasms. In Lithuania, ITB therapy was introduced in clinical practice just recently. We share our experience of spasticity management with the ITB pump system in five patients at Vilnius University Hospital Santariskiu Klinikos. Four patients had spastic tetraplegia associated with cerebral palsy, and one patient developed spastic paraplegia after a spinal epidural abscess.

[PMID: 27903018](#)

7. Correlation between transverse plan kinematics and foot progression angle in children with spastic diplegia.

Presedo A, Simon AL, Mallet C, Ilharreborde B, Mazda K, Pennecot GF.

J Pediatr Orthop B. 2016 Nov 29. [Epub ahead of print]

In diplegic patients, the orientation of foot progression depends on multiple factors. We investigated the relationship between foot progression alignment, hip and pelvic rotations during gait, femoral anteversion, and tibial torsion. Kinematic and clinical parameters were evaluated for 114 children who walked independently and had not undergone previous surgery. Causes of intoeing presented combined in 72% of cases. Internal foot progression correlated with internal hip rotation and showed an inverse correlation with tibial torsion. Our results indicate that data from clinical examination and gait analysis should be evaluated carefully before making treatment recommendations, especially in terms of the correction of torsional problems, in patients with cerebral palsy.

[PMID: 27902635](#)

8. Selective motor control correlates with gait abnormality in children with cerebral palsy.

Chruscikowski E, Fry NR, Noble JJ, Gough M, Shortland AP.

Gait Posture. 2016 Nov 19;52:107-109. doi: 10.1016/j.gaitpost.2016.11.031. [Epub ahead of print]

Children with bilateral cerebral palsy (CP) commonly have limited selective motor control (SMC). This affects their ability to complete functional tasks. The impact of impaired SMC on walking has yet to be fully understood. Measures of SMC have been shown to correlate with specific characteristics of gait, however the impact of SMC on overall gait pattern has not been reported. This study explored SMC data collected as part of routine gait analysis in children with bilateral CP. As part of their clinical assessment, SMC was measured with the Selective Control Assessment of the Lower Extremities (SCALE) in 194 patients with bilateral cerebral palsy attending for clinical gait analysis at a single centre. Their summed SCALE score was compared with overall gait impairment, as measured by Gait Profile Score (GPS). Score on SCALE showed a significant negative correlation with GPS ($r_s = -0.603$, $p < 0.001$). Cerebral injuries in CP result in damage to the motor tracts responsible for SMC. Our results indicate that this damage is also associated with changes in the development of walking pattern in children with CP.

[PMID: 27889619](#)

9. Stability and migration across femoral varus derotation osteotomies in children with neuromuscular disorders.

Buxbom P, Sonne-Holm S, Ellitsgaard N, Wong C.

Acta Orthop. 2016 Nov 28:1-7. [Epub ahead of print]

Studies have indicated that one-third of children with cerebral palsy (CP) develop dislocation of the hip that needs surgical intervention. When hip dislocation occurs during childhood surgical treatment consists of tenotomies, femoral varus derotation osteotomy (VDRO), and acetabuloplasty. Relapse is observed in one-fifth of cases during adolescence. In this prospective cohort study, we performed a descriptive evaluation of translation and rotation across VDROs in children with neuromuscular disorders and syndromes by radiostereometric analysis (RSA). We assessed "RSA stability" and migration across the VDROs. Patients and methods - Children with a neuromuscular disorder were set up for skeletal corrective surgery of the hip. RSA follow-ups were performed postoperatively, at 5 weeks, and 3, 6, and 12 months after surgery. Results - 27 femoral VDROs were included; 2 patients were excluded during the study period. RSA data showed stability across the VDRO in the majority of cases within the first 5 weeks. At the 1-year follow-up, the mean translations (SD) of the femoral shaft distal to the VDRO were 0.51 (1.12) mm medial, 0.69 (1.61) mm superior, and 0.21 (1.28) mm posterior. The mean rotations were 0.39° (2.90) anterior tilt, 0.02° (3.07) internal rotation, and 2.17° (2.29) varus angulation. Interpretation - The migration stagnates within the first 5 weeks, indicating stability across the VDRO in most patients.

[PMID: 27892801](#)

10. Severe hip displacement reduces health-related quality of life in children with cerebral palsy.

Ramstad K, Jahnsen RB, Terjesen T.

Acta Orthop. 2016 Nov 28:1-6. [Epub ahead of print]

Hip displacement is common in children with severe cerebral palsy (CP) and can cause problems such as pain, contractures, and nursing difficulties. Caregiver priorities and child health index of life with disabilities (CPCHILD) is a recently developed measure of health-related quality of life (HRQL) in children with severe CP. The associations between CPCHILD scores and hip displacement have not been investigated. We explored the effect of hip displacement on HRQL. Patients and methods - 67 children were recruited from the population-based Norwegian CP register. Mean age was 9 (7-12) years. There were 40 boys. Gross motor function classification system (GMFCS) distribution was 12 level III, 17 level IV, and 38 level V. Hip displacement was assessed by radiographic migration percentage (MP). The criterion for hip displacement was MP of the worst hip of $\geq 40\%$. Primary caregivers responded to 5 of the 6 domains of the CPCHILD questionnaire. Results - Hip displacement was found in 18 children and it was significantly associated with lower scores on the CPCHILD domains 3 (Comfort and Emotions) and 5 (Health), but not with domains 1 (Activities of Daily Living/Personal Care), 2 (Positioning, Transfer, and Mobility), and 6 (Overall Quality of Life). GMFCS level V was a significant predictor of low scores in all the domains. Interpretation - For the assessment of HRQL in children with severe CP and hip problems, we propose a modified and simplified version of the CPCHILD consisting of 14 of 37 questions. This would reduce the responders' burden and probably increase the response rate in clinical studies without losing important information.

[PMID: 27892753](#)

11. Does unilateral single-event multilevel surgery improve gait in children with spastic hemiplegia? A retrospective analysis of a long-term follow-up.

Schranz C, Kruse A, Kraus T, Steinwender G, Svehlik M.

Gait Posture. 2016 Nov 15;52:135-139. doi: 10.1016/j.gaitpost.2016.11.018. [Epub ahead of print]

Single event multilevel surgery (SEMLS) has become a standard intervention for children with cerebral palsy (CP). SEMLS proved to improve the gait in bilateral spastic cerebral palsy and those improvements can be maintained in the long term. However there is no evidence on the long-term outcome of unilateral SEMLS in children with unilateral spastic cerebral palsy. The gait analyses and clinical data of 14 children (9 male/5 female, mean age 12.1) with unilateral CP (6 children Gross Motor Function Classification System Scale level I and 8 children level II) were retrospectively reviewed at four time-points: preoperatively, 1 year, 3-5 years and approximately 10 years after unilateral SEMLS. The Gait Profile Score (GPS) of the affected leg was used as a main and the number of fine tuning procedures as well as complications rate (Clavien-Dindo classification) as secondary outcome measures.

The gait improved postoperatively and the GPS of the affected leg significantly declined by 3.73° which is well above the minimal clinical important difference of 1.6°. No deterioration of GPS occurred throughout the follow-up period. Therefore the postoperative improvement was maintained long-term.

However, additional fine-tuning procedures had to be performed during the follow-up in 5 children and three complications occurred (one level II and two level III). The results indicate that children with unilateral cerebral palsy benefit from unilateral SEMLS and maintain gait improvements long-term.

[PMID: 27907872](#)

12. Systematic review of physical activity and exercise interventions to improve health, fitness and well-being of children and young people who use wheelchairs.

O'Brien TD, Noyes J, Spencer LH, Kubis HP, Hastings RP, Whitaker R.

BMJ Open Sport Exerc Med. 2016 Nov 15;2(1):e000109. eCollection 2016.

To perform a systematic review establishing the current evidence base for physical activity and exercise interventions that promote health, fitness and well-being, rather than specific functional improvements, for children who use wheelchairs. A systematic review using a mixed methods design. A wide range of databases, including Web of Science, PubMed, BMJ Best Practice, NHS EED, CINAHL, AMED, NIKAN, PsychINFO, were searched for quantitative, qualitative and health economics evidence. Participants: children/young people aged >25 years who use a wheelchair, or parents and therapists/carers. Intervention: home-based or community-based physical activity to improve health, fitness and well-being. Thirty quantitative studies that measured indicators of health, fitness and well-being and one qualitative study were included. Studies were very heterogeneous preventing a meta-analysis, and the risk of bias was generally high. Most studies focused on children with cerebral palsy and used an outcome measure of walking or standing, indicating that they were generally designed for children with already good motor function and mobility. Improvements in health, fitness and well-being were found across the range of outcome types. There were no reports of negative changes. No economics evidence was found. It was found that children who use wheelchairs can participate in physical activity interventions safely. The paucity of robust studies evaluating interventions to improve health and fitness is concerning. This hinders adequate policymaking and guidance for practitioners, and requires urgent attention. However, the evidence that does exist suggests that children who use wheelchairs are able to experience the positive benefits associated with appropriately designed exercise.

[PMID: 27900176](#)

13. High-intensity interval training to improve fitness in children with cerebral palsy.

Lauglo R, Vik T, Lamvik T, Stensvold D, Finbråten AK, Moholdt T.

BMJ Open Sport Exerc Med. 2016 May 9;2(1):e000111. eCollection 2016.

To evaluate effects of high-intensity interval training (HIT) on aerobic exercise capacity, quality of life, and body composition in children with cerebral palsy (CP). This was a baseline control trial. Children with CP, Gross Motor Function Classification System (GMFCS) levels I-IV, and age 10-17 years were included. The primary outcome, peak, and submaximum oxygen uptake (VO₂peak, VO₂submax) were measured at enrolment to the study (T0), after a pretraining period (T1), and after HIT (T2). Secondary outcomes were quality of life assessed with the KINDL questionnaire, and body composition measured using whole body dual-energy X-ray absorptiometry scanning. The exercise was performed on treadmills and consisted of 24 sessions, each with a total of 16 min of exercise at >85% of maximal heart rate. 20 children were included and 6 children dropped out. VO₂peak increased by 10%, from a median of 37.3 (31.0-40.1) to 41.0 (36.6-48.5) mL/kg/min from T1 to T2 (p<0.01). VO₂submax did not change; thereby, the percentage oxygen utilisation was reduced. Body composition was unchanged. Parent-reported quality of life improved, whereas quality of life reported by the children did not improve. Aerobic exercise capacity improved and per cent utilisation of VO₂max declined after HIT in children with CP. Therefore, HIT can be a time efficient way to improve maximal capacity, and increase energy reserve in this patient group.

[PMID: 27900177](#)

14. Ability of independently ambulant children with cerebral palsy to ride a two-wheel bicycle: a case-control study.

Toovey R, Reid SM, Rawicki B, Harvey AR, Watt K.

Dev Med Child Neurol. 2016 Nov 30. doi: 10.1111/dmcn.13340. [Epub ahead of print]

Limited information exists on the ability of children with cerebral palsy (CP) to ride a two-wheel bicycle, an activity that may improve health and participation.

We aimed to describe bicycle-riding ability and variables associated with ability to ride in children with CP (Gross Motor Functional Classification System [GMFCS] levels I-II) compared with children with typical development. This case-control study surveyed parents of 114 children with CP and 87 children with typical development aged 6 to 15 years (115 males, mean age 9y 11mo, standard deviation [SD] 2y 10mo). Kaplan-Meier methods were used to compare proportions able to ride at any given age between the two groups. Logistic regression was used to assess variables associated with ability to ride for children with CP and typical development separately. The proportion of children with CP able to ride at each level of bicycle-riding ability was substantially lower at each age than peers with typical development ($p < 0.001$). While most children with typical development were able to ride independently by 10 years of age, 51% of children with CP classified as GMFCS level I and 3% of those classified as GMFCS level II had obtained independent riding in the community by 15 years of age. Variables associated with ability to ride for children classified as GMFCS level I were age and parent-rated importance of their child being able to ride. Some independently ambulant children with CP can learn to ride a bicycle, in particular if they are classified as GMFCS level I. Variables associated with ability to ride deserve consideration in shaping future efforts for the majority of this population who are not yet able to ride.

[PMID: 27901269](#)

15. Effects of Three Weeks of Whole-Body Vibration Training on Joint-Position Sense, Balance, and Gait in Children with Cerebral Palsy: A Randomized Controlled Study.

Ko MS, Sim YJ, Kim DH, Jeon HS.

Physiother Can. 2016;68(2):99-105.

Purpose : To observe the effects of whole-body vibration (WBV) training in conjunction with conventional physical therapy (PT) on joint-position sense (JPS), balance, and gait in children with cerebral palsy (CP). **Methods:** In this randomized controlled study, 24 children with CP were randomly selected either to continue their conventional PT or to receive WBV in conjunction with their conventional PT programme. Exposure to the intervention was intermittent (3 min WBV, 3 min rest) for 20 minutes, twice weekly for 3 weeks. JPS, balance, and gait were evaluated before and after treatment. **Results:** Ankle JPS was improved after 3 weeks of WBV training ($p=0.014$). Participants in the WBV group showed greater improvements in speed ($F_{1,21}=5.221$, $p=0.035$) and step width ($F_{1,21}=4.487$, $p=0.039$) than participants in the conventional PT group. **Conclusion:** Three weeks of WBV training was effective in improving ankle JPS and gait variables in children with CP.

[PMID: 27909356](#)

16. Effectiveness of Exercise on Functional Mobility in Adults with Cerebral Palsy: A Systematic Review.

Lawrence H, Hills S, Kline N, Weems K, Doty A.

Physiother Can. 2016;68(4):398-407.

Purpose: We identified evidence evaluating the effect of exercise on functional mobility in adults (aged 18 y or older) with cerebral palsy (CP). **Method:** An exhaustive search was conducted using the electronic databases PubMed, MEDLINE, CINAHL, PsycINFO, SPORTDiscus, and Cochrane Database of Systematic Reviews from the earliest available evidence (1975) to the present (January 2016) for studies whose participants were ambulatory adults with CP receiving conservative treatment to address functional mobility limitations. Two independent reviewers agreed on the eligibility, inclusion, and level of evidence of each study. The Maastricht-Amsterdam List (MAL) was used to assess evidence quality. **Results:** Five of the six studies included were randomized controlled trials, and one was a pre-post case series. Interventions included whole-body vibration, treadmill training without body-weight support, rhythmic auditory stimulation, dynamic balance and gait activities, progressive resistance training, and interactive serious gaming for balance. All studies were considered high quality, as indicated by their MAL scores. Four studies showed no statistical difference and trivial effect sizes between the intervention and the control group.

Rhythmic auditory stimulation and interactive serious gaming were found to be statistically significant in benefiting adults with CP. Conclusions: Evidence of the effect of exercise on functional mobility for ambulatory adults with CP is lacking. A need exists for quality research to determine the best interventions for adults with CP to maximize functional mobility.

[PMID: 27904240](#)

17. Pre-operative walking activity in youth with cerebral palsy.

Nicholson K, Lennon N, Hulbert R, Church C, Miller F.

Res Dev Disabil. 2016 Nov 29;60:77-82. doi: 10.1016/j.ridd.2016.11.011. [Epub ahead of print]

No data are available regarding level of walking activity for youth with cerebral palsy (CP) before undergoing orthopaedic surgery. The goals of this study were to quantify pre-operative walking activity, and determine whether pre-operative values are different from previously defined levels of walking activity in youth with CP. This study retrospectively evaluated pre-operative walking activity in youth with spastic CP, GMFCS levels I-IV. Walking activity was monitored using the StepWatch™. Outcome variables included mean daily strides, percent of day active, and percent of active time at high activity. Differences between GMFCS levels were examined and comparisons were made to published data. Pre-operative walking activity data from 126 youth with CP were included. All variables demonstrated higher walking activity in youth at GMFCS levels I/II compared to those at GMFCS levels III/IV. When compared to previously defined walking activity levels, pre-operative walking activity was lower. Walking activity among pre-operative youth with CP is significantly lower than published data for ambulatory youth with CP. Results suggest that youth with CP who are surgical candidates have less walking activity than youth with CP without surgical needs. Therefore this study should encourage the effort to collect and analyze individual pre-operative data for comparison and evaluation of post-operative functional recovery.

[PMID: 27912105](#)

18. Interventions to improve gross motor performance in children with neurodevelopmental disorders: a meta-analysis.

Lucas BR, Elliott EJ, Coggan S, Pinto RZ, Jirikowic T, McCoy SW, Latimer J.

BMC Pediatr. 2016 Nov 29;16(1):193.

Gross motor skills are fundamental to childhood development. The effectiveness of current physical therapy options for children with mild to moderate gross motor disorders is unknown. The aim of this study was to systematically review the literature to investigate the effectiveness of conservative interventions to improve gross motor performance in children with a range of neurodevelopmental disorders. A systematic review with meta-analysis was conducted. MEDLINE, EMBASE, AMED, CINAHL, PsycINFO, PEDro, Cochrane Collaboration, Google Scholar databases and clinical trial registries were searched. Published randomised controlled trials including children 3 to ≤18 years with (i) Developmental Coordination Disorder (DCD) or Cerebral Palsy (CP) (Gross Motor Function Classification System Level 1) or Developmental Delay or Minimal Acquired Brain Injury or Prematurity (<30 weeks gestational age) or Fetal Alcohol Spectrum Disorders; and (ii) receiving non-pharmacological or non-surgical interventions from a health professional and (iii) gross motor outcomes obtained using a standardised assessment tool. Meta-analysis was performed to determine the pooled effect of intervention on gross motor function. Methodological quality and strength of meta-analysis recommendations were evaluated using PEDro and the GRADE approach respectively. Of 2513 papers, 9 met inclusion criteria including children with CP (n = 2) or DCD (n = 7) receiving 11 different interventions. Only two of 9 trials showed an effect for treatment. Using the least conservative trial outcomes a large beneficial effect of intervention was shown (SMD:-0.8; 95% CI:-1.1 to -0.5) with "very low quality" GRADE ratings. Using the most conservative trial outcomes there is no treatment effect (SMD:-0.1; 95% CI:-0.3 to 0.2) with "low quality" GRADE ratings. Study limitations included the small number and poor quality of the available trials. Although we found that some interventions with a task-orientated framework can improve gross motor outcomes in children with DCD or CP, these findings are limited by the very low quality of the available evidence. High quality intervention trials are urgently needed.

[PMID: 27899082](#)

19. Negative effects of submandibular botulinum neurotoxin A injections on oral motor function in children with drooling due to central nervous system disorders.

van Hulst K, Kouwenberg CV, Jongerius PH, Feuth T, van den Hoogen FJ, Geurts AC, Erasmus CE.

Dev Med Child Neurol. 2016 Nov 30. doi: 10.1111/dmcn.13333. [Epub ahead of print]

The aims of this study were: (1) to determine the incidence and nature of adverse effects on oral motor function after first injections of botulinum neurotoxin A (BoNT-A) in submandibular glands for excessive drooling in children with central nervous system disorders; and (2) to identify independent predictors of these adverse effects.

A cohort study involved 209 children (123 males, 86 females, aged 4-27y, median 8y 4mo), who received submandibular BoNT-A injections for drooling. Adverse effects were categorized into swallowing, eating, drinking, articulation, and other problems. Univariable logistic regression was used to study differences in patients with and without adverse effects. Possible predictors were identified using multivariable logistic regression. Transient adverse effects occurred in 33% of the 209 BoNT-A treatments. Almost 80% of these were mild, versus 8.7% severe. Approximately 54% of the adverse effects spontaneously resolved within 4 weeks; 3% still existed after 32 weeks. A diagnosis of cerebral palsy, higher range of BoNT-A dosage, and a pre-treatment drooling quotient <18% were found to be independent predictors of adverse effects. Before using submandibular BoNT-A injections for drooling, potential adverse effects should be discussed. Oral motor function needs to be monitored, because existing dysphagia may be worsened. The identified clinical predictors could be helpful to optimize patient selection.

[PMID: 27901263](#)

20. Speech and language interventions for infants aged 0 to 2 years at high risk for cerebral palsy: a systematic review.

Chorna O, Hamm E, Cummings C, Fetters A, Maitre NL.

Dev Med Child Neurol. 2016 Nov 29. doi: 10.1111/dmcn.13342. [Epub ahead of print]

We evaluated the level of evidence of speech, language, and communication interventions for infants at high-risk for, or with a diagnosis of, cerebral palsy (CP) from 0 to 2 years old. We performed a systematic review of relevant terms. Articles were evaluated based on the level of methodological quality and evidence according to A Measurement Tool to Assess Systematic Reviews (AMSTAR) and Grading of Recommendations Assessment, Development and Evaluation (GRADE) guidelines. The search terms provided 17 publications consisting of speech or language interventions. There were no interventions in the high level of evidence category. The overall level of evidence was very low. Promising interventions included Responsivity and Prelinguistic Milieu Teaching and other parent-infant transaction frameworks. There are few evidence-based interventions addressing speech, language, and communication needs of infants and toddlers at high risk for CP, and none for infants diagnosed with CP. Recommendation guidelines include parent-infant transaction programs.

[PMID: 27897320](#)

21. Inducing speech errors in dysarthria using tongue twisters.

Kember H, Connaghan K, Patel R.

Int J Lang Commun Disord. 2016 Nov 27. doi: 10.1111/1460-6984.12285. [Epub ahead of print]

Although tongue twisters have been widely used to study speech production in healthy speakers, few studies have employed this methodology for individuals with speech impairment. The present study compared tongue twister errors produced by adults with dysarthria and age-matched healthy controls. Eight speakers (four female, four male; mean age = 54.5 years) with spastic (mixed-spastic) dysarthria of varying aetiology (cerebral palsy, multiple sclerosis, multiple system atrophy) and eight controls (four female, four male; mean age = 56.9 years) were audio-recorded producing tongue twisters. One word in each tongue twister was marked for prominence. Speakers with dysarthria produced significantly more errors and spoke slower than healthy controls. The effect of prominence was significant for both groups—words spoken with prosodic prominence were significantly less error prone compared with words without prominence. While both groups produced most errors on words in the third position (of four-word utterances), speakers with dysarthria also produced high rates of errors on the first and fourth words. This preliminary investigation demonstrated the promise of applying the tongue twister paradigm to speakers with dysarthria and contributes to the evidence base for the implementation of prosodic strategies in speech intervention.

[PMID: 27891744](#)

22. Understanding leisure preferences of young people with cerebral palsy.

Copley J.

Dev Med Child Neurol. 2016 Nov 25. doi: 10.1111/dmcn.13357. [Epub ahead of print]

This commentary is on the original article by Imms et al.

[PMID: 27888507](#)**23. "My Child has Cerebral Palsy": Parental Involvement and Children's School Engagement.**

Pereira A, Moreira T, Lopes S, Nunes AR, Magalhães P, Fuentes S, Reoyo N, Núñez JC, Rosário P.

Front Psychol. 2016 Nov 11;7:1765. eCollection 2016.

Engaged students tend to show school-committed behaviors (e.g., attend classes, get involved with the learning process), high achievement, and sense of belonging. However, students with disabilities are prone to show a lack of engagement with school due to the specific difficulties they have to handle. In fact, children with disabilities are likely to show poor participation in school when compared with children without disabilities. This poor involvement is related to their low autonomy to participate in the school activities, which, in turn, results in low school engagement. Parents play a crucial role in their children's education. Parental involvement in school activities promotes autonomous behaviors and, consequently, school engagement. In fact, extant literature has shown close relationships between parental involvement, school engagement, and academic performance. Yet, parental involvement in school activities of children with Cerebral Palsy (CP) has received little direct attention from researchers. These children tend to display lower participation due to the motor, or cognitive, impairments that compromise their autonomy, and have a high likelihood to develop learning disabilities, with special incidences in reading and arithmetic. Therefore, our aim is twofold, to understand the parental styles; and how the perceived parental involvement in school activities is related to their children school engagement. Hence, 19 interviews were conducted with one of the parents of 19 children with CP. These interviews explored the school routines of children and the perceived involvement of parents in those routines. Additionally, children filled out a questionnaire on school engagement. Results show that the majority of the parents were clustered in the Autonomy Allowance and Acceptance and Support parental style, and the majority of their children were perceived as autonomous. Moreover, about a half of the children reported a high level of school engagement. Finally, neither children's autonomous behaviors reported by parents, nor parental style, seem to be related with the children's level of school engagement. Rehabilitation centers and schools could consider training parents/caregivers focusing on their educational needs, promotion of reflections on the usefulness of applying autonomy promotion strategies with their child, and foster their involvement.

[PMID: 27891110](#)

Prevention and Cure

24. Electronic foetal monitoring, cerebral palsy, and caesarean section: assumptions versus evidence.

Nelson KB, Sartwelle TP, Rouse DJ.

BMJ. 2016 Dec 1;355:i6405. doi: 10.1136/bmj.i6405.

Given evidence that cerebral palsy is not reduced by electronic fetal monitoring, Karin Nelson, Thomas Sartwelle, and Dwight Rouse ask why routine monitoring and related litigation continue to contribute to high rates of caesarean births.

[PMID: 27908902](#)**25. Hospital admissions in children with cerebral palsy: a data linkage study.**

Meehan E, Reid SM, Williams K, Freed GL, Sewell JR, Vidmar S, Donath S, Reddihough DS.

Dev Med Child Neurol. 2016 Nov 30. doi: 10.1111/dmcn.13350. [Epub ahead of print]

The overall aim was to investigate the feasibility and utility of linking a cerebral palsy (CP) register to an administrative data set for health services research purposes. We sought to compare CP hospital admissions to general childhood population admissions, and identify factors associated with type and frequency of admissions in a CP cohort. The CP register for Victoria, Australia was linked to the state's hospital admissions database. Data pertaining to the admissions of a CP cohort (n=1748) that took place between 2007 and 2014 were extracted. Population data were also obtained. Overall, 80% of the CP cohort (n=1401) had at least admission between 2007 and 2014, accounting for 11 012 admissions or 1.5% of all admissions in their age group.

Compared to general population admissions, CP admissions were more costly and more likely to be elective (66% vs 57%; $p < 0.001$), medical (71% vs 57%; $p < 0.001$), and to take place in metropolitan hospitals (92% vs 78%; $p < 0.001$). Increased CP severity and complexity were associated with having more admissions and a higher proportion of admissions attributable to respiratory illness. By linking with administrative data sets, CP registers may be useful for health services research and inform health service delivery.

[PMID: 27900776](#)

26. Completeness and correctness of cerebral palsy diagnoses in two health registers: implications for estimating prevalence.

Hollung SJ, Vik T, Wiik R, Bakken IJ, Andersen GL.

Dev Med Child Neurol. 2016 Nov 29. doi: 10.1111/dmcn.13341. [Epub ahead of print]

To assess completeness and correctness of cerebral palsy (CP) diagnoses in the Cerebral Palsy Register of Norway (CPRN) and the Norwegian Patient Register (NPR), and to estimate CP prevalence. Among 747 883 Norwegian residents born from 1996 to 2007, 2231 had a diagnosis of CP in the NPR while 1441 were registered in the CPRN. Children registered in the CPRN were considered to have a valid CP diagnosis. For those with a diagnosis of CP only in the NPR, two paediatricians reviewed the hospital records. The prevalence rate of CP with 95% confidence intervals (CI) was calculated on the basis of the combined data sets. One thousand three hundred and ninety-eight children were registered with a diagnosis of CP in both registers, 43 children were only registered in the CPRN, and 824 only in the NPR. The review of hospital records revealed that 464 (59.5%) had CP. Thus, the NPR was 98% complete, and for 86% the diagnosis was correct. The completeness of the CPRN was 76%, while the diagnosis was considered correct for all children (100%). The resulting prevalence of CP was 2.5 (95% CI 2.4-2.7) per 1000. To gain accurate estimates of prevalence rates of CP, it is essential to combine data sources and to validate register data.

[PMID: 27896812](#)

27. Neonatal diffusion tensor brain imaging predicts later motor outcome in preterm neonates with white matter abnormalities.

Kim DY, Park HK, Kim NS, Hwang SJ, Lee HJ.

Ital J Pediatr. 2016 Dec 1;42(1):104.

White matter (WM) abnormalities associated with prematurity are one of the most important causes of neurological disability that involves spastic motor deficits in preterm newborns. This study aimed to evaluate regional microstructural changes in diffusion tensor imaging (DTI) associated with WM abnormalities. We prospectively studied extremely low birth weight (ELBW; <1000 g) preterm infants who were admitted to the Neonatal Intensive Care Unit of Hanyang University Hospital between February 2011 and February 2014. WM abnormalities were assessed with conventional magnetic resonance (MR) imaging and DTI near term-equivalent age before discharge. Region-of-interests (ROIs) measurements were performed to examine the regional distribution of fractional anisotropy (FA) values. Thirty-two out of 72 ELBW infants underwent conventional MR imaging and DTI at term-equivalent age. Ten of these infants developed WM abnormalities associated with prematurity. Five of ten of those with WM abnormalities developed cerebral palsy (CP). DTI in the WM abnormalities with CP showed a significant reduction of mean FA in the genu of the corpus callosum ($p = 0.022$), the ipsilateral posterior limb of the internal capsule ($p = 0.019$), and the ipsilateral centrum semiovale ($p = 0.012$) compared to normal WM and WM abnormalities without CP. In infants having WM abnormalities with CP, early FA values in neonatal DTI revealed abnormalities of the WM regions prior to the manifestation of hemiparesis. DTI performed at term equivalent age shows different FA values in WM regions among infants with or without WM abnormalities associated with prematurity and/or CP. Low FA values of ROIs in DTI are related with later development of spastic CP in preterm infants with WM abnormalities.

[PMID: 27906083](#)

28. Visual Function and Ocular Status in Children with Disabilities in Special Schools of Northern India.

Kaur G, Thomas S, Jindal M, Bhatti SM

J Clin Diagn Res. 2016 Oct;10(10):NC01-NC04. Epub 2016 Oct 1.

Children with disabilities (other than visual impairment) are at a higher risk of visual impairment as compared to normal population. Majority of the ocular disorders, like refractive errors and strabismus, are easily treatable. As these children depend on their visual inputs for social and academic activities, an early detection and prompt treatment of even a minor visual problem is of utmost importance for them. To assess the visual function and ocular status of children with disabilities other than visual impairment and to identify the preventable and treatable causes of visual impairment. The study was conducted on children aged 3-16 years who were studying in special schools/ rehabilitation centers in Ludhiana. After prior permission, detailed ocular examination of all the children was done using standard examination techniques. Cycloplegic retinoscopy and refraction was also done and spectacles were prescribed. Children requiring further evaluation were referred to base hospital. A total of 404 children with disabilities (other than visual disabilities) studying in 7 rehabilitation centers/ special schools were enrolled. These included children with Cerebral palsy (12.1%), with Hearing impairment (35.3%), with Attention Deficit Hyperactive Disorder (ADHD) (3.7%), with Autism (8.6%), with Down syndrome (12.8%) and with Mental retardation (27.2%). Ocular disorders were seen in 174(43%) children. The most common ocular disorders seen in these children were refractive errors (23%) and strabismus (18.1%). A total of 93(23%) children were prescribed spectacles and 37(9.2%) children were referred for further evaluation. Ocular problems are common in children with other disabilities. Delay in the detection and treatment of these disorders compounds the already existing disability in these children. Lack of awareness and sensitization among the parents and teachers is a matter of great concern. Therefore, strategies regarding increasing awareness, mandatory ocular examination in these children and early detection and treatment of the ocular disorders is the need of the hour.

[PMID: 27891365](#)

29. Prognostic factors of neurological outcomes in late-preterm and term infants with perinatal asphyxia.

Seo SY, Shim GH, Chey MJ, You SJ.

Korean J Pediatr. 2016 Nov;59(11):440-445. Epub 2016 Nov 18.

This study aimed to identify prognostic factors of neurological outcomes, including developmental delay, cerebral palsy and epilepsy in late-preterm and term infants with perinatal asphyxia. All late-preterm and term infants with perinatal asphyxia or hypoxic-ischemic insults who admitted the neonatal intensive care unit of Inje University Sanggye Paik Hospital between 2006 and 2014 and were followed up for at least 2 years were included in this retrospective study. Abnormal neurological outcomes were defined as cerebral palsy, developmental delay and epilepsy. Of the 114 infants with perinatal asphyxia, 31 were lost to follow-up. Of the remaining 83 infants, 10 died, 56 had normal outcomes, and 17 had abnormal outcomes: 14 epilepsy (82.4%), 13 cerebral palsy (76.5%), 16 developmental delay (94.1%). Abnormal outcomes were significantly more frequent in infants with later onset seizure, clinical seizure, poor electroencephalography (EEG) background activity, lower Apgar score at 1 and 5 minutes and abnormal brain imaging ($P<0.05$). Infants with and without epilepsy showed significant differences in EEG background activity, clinical and electrographic seizures on EEG, Apgar score at 5 minutes and brain imaging findings. We should apply with long-term video EEG or amplitude integrated EEG in order to detect and management subtle clinical or electrographic seizures in neonates with perinatal asphyxia. Also, long-term, prospective studies with large number of patients are needed to evaluate more exact prognostic factors in neonates with perinatal asphyxia.

[PMID: 27895691](#)

30. Caffeine for apnea of prematurity: Effects on the developing brain.

Atik A, Harding R, De Matteo R, Kondos-Devic D, Cheong J, Doyle LW, Tolcos M.

Neurotoxicology. 2016 Nov 27;58:94-102. doi: 10.1016/j.neuro.2016.11.012. [Epub ahead of print]

Caffeine is a methylxanthine that is widely used to treat apnea of prematurity (AOP). In preterm infants, caffeine reduces the duration of respiratory support, improves survival rates and lowers the incidence of cerebral palsy and cognitive delay. There is, however, little evidence relating to the immediate and long-term effects of caffeine on brain development, especially at the cellular and molecular levels. Experimental data are conflicting, with studies showing that caffeine can have either adverse or beneficial effects in the developing brain. The aim of this article is to review current understanding of how caffeine ameliorates AOP, the cellular and molecular mechanisms by which caffeine exerts its effects and the effects of caffeine on brain development. A better knowledge of the effects of caffeine on the developing brain at the cellular and/or molecular level is essential in order to understand the basis for the impact of caffeine on postnatal outcome. The studies reviewed here suggest that while caffeine has respiratory benefits for preterm infants, it may have adverse molecular and cellular effects on the developing brain; indeed a majority of experimental studies suggest that regardless of dose or duration of administration, caffeine leads to detrimental changes within the developing brain. Thus there is an urgent need to assess the impact of caffeine, at a range of doses, on the structure and function of the developing brain in preclinical studies, particularly using clinically relevant animal models. Future studies should focus on determining the maximal dose of caffeine that is safe for the preterm brain.

[PMID: 27899304](#)