Science Infos
Paralysie Cérébrale

N° 3O/31 – NOVEMBRE DECEMBRE 2016

FONDATION PARALYSIE CÉRÉBRALE LA FONDATION MOTRICE

Focus

Huit équipes de recherche distinguées par La Fondation Paralysie Cérébrale/La Fondation Motrice en 2017 pour des projets de qualité et innovants dans la prévention et la prise en charge de la Paralysie Cérébrale

Afin de promouvoir et soutenir la recherche et l'innovation relatives à la Paralysie Cérébrale (PC) et de façon très large tout ce qui peut contribuer à la prévention et l'amélioration de la situation et de la qualité de vie des personnes atteintes de PC, La Fondation Paralysie Cérébrale/La Fondation Motrice a lancé en avril 2016 un double appel à projets avec

d'une part ***un appel à projet général*** visant à soutenir toute étude clinique ou expérimentale spécifiquement centrée sur la PC, sa prévention et ses conséquences chez les personnes concernées, quel que soit leur âge

et d'autre part ***un appel à projets rééducation*** visant à soutenir des projets de recherche pouvant documenter et apporter des preuves supplémentaires en rééducation motrice ou cognitive chez le sujet avec PC.

Huit équipes européennes distinguées par le Conseil Scientifique et le Conseil d'Administration de la Fondation pour la qualité, l'originalité et l'apport de leur projet à une meilleure connaissance de la prévention et de la prise en charge de la PC bénéficieront en 2017 d'un financement de la Fondation.

- Dr M GAZZONI (Turin, Italie) Les jeux sérieux basés sur l'électromyographie (EMG) améliorent ils la démarche des enfants avec PC ?

67 rue Vergniaud 75013 Paris - tel +33 1 45 54 03 03 contact: Christine Doumergue
cdoumergue@lafondationmotrice.org

- Pr JM GRACIES (Créteil, France) Caractérisation de la myopathie spastique, sur les plans clinique, biomécanique, histo-immunologique et radiologique chez des patients adultes atteints de parésie spastique après paralysie cérébrale et après un accident vasculaire cérébral.
- Pr P HOEBEKE (Gand, Belgique) Rééducation mictionelle chez les enfants avec PC.
- Dr J MAIRESSE (Paris, France) Activation précoce des récepteurs à l'ocytocine et neuro-protection vis-à-vis des dommages inflammatoires du nouveau-né exposé à une réduction de la croissance intra-utérine.
- Dr C NEWMAN (Lausanne, Suisse) Impact de la paralysie cérébrale sur l'appropriation du corps.
- Dr J PUYAL (Lausanne, Suisse) Définition des voies de signalisation Na+K+ ATP ase dépendant impliqués dans la mort neuronale après hypoxie-ischémie.
- Dr A RIDEAU (Paris, France) Handicaps neurocognitifs associés à un retard de croissance intra utérin : Régulation de la neuroinflammation, une nouvelle cible pour la neuroprotection.
- Dr P VAN DE WALLE (Anvers, Belgique) Relation entre niveau d'activité physique et condition cardio-respiratoire chez les enfants PC ambulatoires âgés de 6 à 8 ans.

La Fondation Paralysie Cérébrale/La Fondation Motrice ainsi que la SESEP accompagneront ces projets qui permettront une amélioration des connaissances dans le domaine de la Paralysie Cérébrale.

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Manifestations et congrès

Janvier 2017

27ème congrès de la Société Française de Neurologie Pédiatrique
18-20 janvier 2017
Paris, France
http://www.sfneuroped.fr/nos-missions/congres-sfnp/

Fevrier 2017

Journées d'études 2017 Polyhandicap et IMC
Troubles du comportement : Repérer, comprendre, prévenir
pour mieux accompagner la personne polyhandicapée et IMC
27-28 Février 2017
Paris, France
http://www.cesap.asso.fr/images/CESAP_Formation/pdf/Programme%20JE%20POLY%20IMC%202017%20Troubles%20du%20comportement%202nd%20dition.pdf

Mars 2017

45èmes Entretiens de Médecine Physique et de réadaptation
15-17 mars 2017
Montpellier, France
http://www.empr.fr/EventPortal/Information/EMPR2017/ACCEUIL.aspx

Mai 2017

29th Annual EACD Meeting,
17-20 mai 2017
Amsterdam, pays bas
http://www.eacd2017.org/

Publications scientifiques

Méthodologie de la recherche

Le profil de veille a été mis en place sur Pubmed avec le mot clé "Cerebral Palsy" pour des publications majoritairement en français ou en anglais, avec abstract ou full text
Free article indique le lien vers les articles dont le texte intégral est librement disponible

Funding for cerebral palsy research in Australia, 2000-2015: an observational study.
Herbert DL, Barnett AG, White R, Novak I, Badawi N
BMJ Open. 2016 Oct 24;6(10):e012924. doi: 10.1136/bmjopen-2016-012924.

OBJECTIVES: To examine the funding for cerebral palsy (CP) research in Australia, as compared with the National Institutes of Health (NIH).
DESIGN: Observational study.
SETTING: For Australia, philanthropic funding from Cerebral Palsy Alliance Research Foundation (CPARF) (2005-2015) was compared with National Health and Medical Research Council (NHMRC, 2000-2015) and Australian Research Council (ARC, 2004-2015) and CPARF and NHMRC funding were compared with NIH funding (USA).
PARTICIPANTS: Cerebral Palsy researchers funded by CPARF, NHMRC or NIH.
RESULTS: Over 10 years, total CPARF philanthropic funding was $21.9 million, including people, infrastructure, strategic and project support. As competitive grants, CPARF funded $11.1 million, NHMRC funded $53.5 million and Australian Research Council funded $1.5 million. CPARF, NHMRC and NIH funding has increased in real terms, but only the NIH statistically significantly increased in real terms (mean annual increase US$4.9 million per year, 95% CI 3.6 to 6.2, p<0.001). The NHMRC budget allocated to CP research remained steady over time at 0.5%. A network analysis indicated the relatively small number of CP researchers in Australia is mostly connected through CPARF or NHMRC funding.
CONCLUSIONS: Funding for CP research from the Australian government schemes has stabilised and CP researchers rely on philanthropic funding to fill this gap. In comparison, the NIH is funding a larger number of CP researchers and their funding pattern is consistently increasing.

Free PMC Article
DOI: 10.1136/bmjopen-2016-012924
PMCID: PMC5093649
PMID: 27798026 [PubMed - in process]

Epidémiologie

Prévalence- Incidence

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.

AIM: 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.
METHOD: 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.
RESULTS: 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.
INTERPRETATION: To gain accurate estimates of prevalence rates of CP, it is essential to combine data sources and to validate register data.

DOI: 10.1111/dmcn.13341
PMID: 27896812 [PubMed - as supplied by publisher]

Persistence of Cerebral Palsy Diagnosis: Assessment of a Low-Birth-Weight Cohort at Ages 2, 6, and 9 Years.
Korzeniewski SJ, Feldman JF, Lorenz JM, Pinto-Martin JA, Whitaker AH, Paneth N.
J Child Neurol. 2016 Mar;31(4):461-7. doi: 10.1177/0883073815599260. Epub 2015 Aug 13.

We examined the stability of nondisabling and disabling cerebral palsy at age 2 in a longitudinally followed tri-county low-birth-weight (<2000 g) birth cohort. A total of 1105 newborns were enrolled, 901 (81.5%) survived to age 2, and 86% (n = 777) were followed up. Of the 113 cerebral palsy diagnoses at age 2, 61 (9% of the cohort, n = 61/777) had disabling cerebral palsy and 52 (7%, n = 52/777) had nondisabling cerebral palsy. Of 48 followed children diagnosed with disabling cerebral palsy at age 2, 98% were again classified as having cerebral palsy at school age, and 1 had an uncertain cerebral palsy status. By contrast, 41% (n = 17) of the 43 children diagnosed with nondisabling cerebral palsy at age 2 were classified as not having cerebral palsy. Of the 517 followed children who were not diagnosed with cerebral palsy at age 2, 7% (n = 35) were classified as having late emerging nondisabling cerebral palsy at school age.

DOI: 10.1177/0883073815599260
PMID: 26271791 [PubMed - indexed for MEDLINE]

The Danish Cerebral Palsy Follow-up Program.
Rasmussen HM(1), Nordbye-Nielsen K(2), Møller-Madsen B, Johansen M, Ellitsgaard N, Pedersen CR, Rackauskaite G, Engberg H, Pedersen NW
Clin Epidemiol. 2016 Oct 25;8:457-460. eCollection 2016.

AIM OF DATABASE: The Danish Cerebral Palsy Follow-up Program is a combined follow-up program and national clinical quality database that aims to monitor and improve the quality of health care for children with cerebral palsy (CP).
STUDY POPULATION: The database includes children with CP aged 0-15 years and children with symptoms of CP aged 0-5 years.
MAIN VARIABLES: In the follow-up program, the children are offered examinations throughout their childhood by orthopedic surgeons, physiotherapists, occupational therapists, and pediatricians. Examinations of gross and fine motor function, manual ability, muscle tone, passive range of motion, use of orthotics, and assistive devices are performed once a year; radiographic examination of the hips is planned based on the child's age and gross motor function; and the diagnosis is performed once before the age of 5 years. Six indicators were developed based on scientific literature and consensus in the steering committee, and their calculation is based on the following four main variables: radiographic examination of the hip, gross motor function, manual ability, and diagnosis.
DESCRIPTIVE DATA: The 2014 annual report includes results of the quality indicators in three of five regions in Denmark comprising 432 children with CP, corresponding to a coverage of 82% of the expected population.
CONCLUSION: The Danish Cerebral Palsy Follow-up Program is currently under development as a national clinical quality database in Denmark. The database holds potential for research in prevalence, clinical characteristics of the population, and the effects of prevention and treatment.
Free PMC Article
DOI: 10.2147/CLEP.S99474

PMCID: PMC5094643
PMID: 27822084 [PubMed - in process]

Facteurs de risque – Causes

Abnormal neurodevelopmental outcomes are very likely in cases of bilateral neonatal arterial ischaemic stroke.
Jin JH, Shin JE, Lee S, Eun HS, Park MS, Park KI, Namgung R
Acta Paediatr. 2016 Nov 3. doi: 10.1111/apa.13655. [Epub ahead of print]

AIM: Neonatal arterial ischaemic stroke (AIS) is an important cause of severe neurological disability. This study aimed to analyse the clinical manifestations and outcomes of AIS patients.
METHODS: We enrolled neonates with AIS admitted to Severance Children's Hospital and Gangnam Severance Hospital between 2008 and 2015. AIS was confirmed using magnetic resonance imaging (MRI). We retrospectively reviewed the clinical manifestations, MRI findings, electroencephalography (EEG) findings and neurodevelopmental outcomes.
RESULTS: The study comprised 29 neonates (18 boys). The mean follow-up period was 15.4 months (range 6-44 months) and the mean age at diagnosis was 8.1 days. Seizure was the most common symptom (66%). Bilateral involvement was more common than unilateral involvement (52%). The middle cerebral artery was the most commonly identified territory (79%). Abnormal EEG findings were noted in 93% of the cases. Neurodevelopment was normal in 11 (38%) patients, while cerebral palsy and delayed development were noted in eight (28%) and six (21%) patients, respectively. Patients with bilateral involvement were very likely to have abnormal neurodevelopmental outcomes.
CONCLUSION: Our study showed that abnormal neurodevelopmental outcomes were very likely after cases of neonatal AIS with bilateral involvement and clinicians should consider early and more effective interventions in such cases. This article is protected by copyright. All rights reserved.

DOI: 10.1111/apa.13655
PMID: 27809371 [PubMed - as supplied by publisher]

Association of Maternal Obesity with Child Cerebral Palsy or Death.
McPherson JA, Smid MC, Smiley S, Stamilio DM
Am J Perinatol. 2016 Nov 17. [Epub ahead of print]

Objective The primary aim of this study was to determine if there is an association between maternal obesity and cerebral palsy or death in children.
Study Design This is a retrospective cohort analysis of a randomized controlled clinical trial previously performed by the Maternal-Fetal Medicine Units Network. Women in the original trial were included if at high risk for preterm delivery. The present study included singletons enrolled in the original study with complete data. Obese and nonobese women were compared. A secondary analysis comparing class 3 obese or classes 1 to 2 obese women to nonobese women was performed. The primary outcome was a composite of cerebral palsy or perinatal death.
Results In this study, 1,261 nonobese, 339 obese, and 69 morbidly obese women were included. When adjusted for gestational age at delivery and magnesium exposure, there was no association between maternal obesity and child cerebral palsy or death. In the analysis using obesity severity categories, excess risk for adverse outcome appeared confined to the class 3 obese group.
Conclusion In women at high risk of delivering preterm, maternal obesity was not independently associated with child cerebral palsy or death. The association in unadjusted analysis appears to be mediated by preterm birth among obese patients.
Thieme Medical Publishers 333 Seventh Avenue, New York, NY 10001, USA.
DOI: 10.1055/s-0036-1594015
PMID: 27855463 [PubMed - as supplied by publisher]

Association of placental weight with cerebral palsy: population-based cohort study in Norway.
Strand KM, Andersen GL, Haavaldsen C, Vik T, Eskild A.
BJOG. 2016 Dec;123(13):2131-2138. doi: 10.1111/1471-0528.13827. Epub 2015 Dec 22.

Comment in BJOG. 2016 Dec;123(13):2139. BJOG. 2016 Dec;123(13):2146.

OBJECTIVE: To study the risk of cerebral palsy (CP) associated with placental weight, and also with placental weight/birthweight ratio and placental weight/birth length ratio.
DESIGN: Population-based cohort study.
SETTING: Perinatal data in the Medical Birth Registry of Norway were linked with clinical data in the CP Register of Norway.
POPULATION: A total of 533 743 singleton liveborn children in Norway during 1999-2008. Of these, 779 children were diagnosed with CP.
METHODS: Placental weight, placental weight/birthweight ratio, and placental weight/birth length ratio were grouped into gestational age-specific quartiles. Odds ratios (OR) with 95% confidence intervals (95% CI) for CP were calculated for children with exposure variables in the lowest or in the highest quartile, using the second to third quartile as the reference.
MAIN OUTCOME MEASURES: CP and CP subtypes.
RESULTS: Overall, children with low placental weight had increased risk for CP (OR 1.5, 95% CI 1.2-1.7). Low placental weight/birthweight ratio (OR 1.2, 95% CI 1.0-1.4) and low placental weight/birth length ratio (OR 1.5, 95% CI 1.2-1.8) were also associated with increased risk for CP. In children born at term, low placental weight was associated with a twofold increase in risk for spastic bilateral CP (including both quadriplegia and diplegia) (OR 2.1, 95% CI 1.5-2.9). In children born preterm, high placental ratios were associated with increased risk for spastic quadriplegia.
CONCLUSIONS: Our results suggest that placental dysfunction may be involved in causal pathways leading to the more severe subtypes of CP.
TWEETABLE ABSTRACT: Low placental weight increases the risk for cerebral palsy, especially for the spastic bilateral subtype.

DOI: 10.1111/1471-0528.13827
PMID: 26692053 [PubMed - indexed for MEDLINE]

Association of severe placental inflammation with death prior to discharge and cerebral palsy in preterm infants.
Huetz N, Triau S, Leboucher B, Sentilhes L, Hanf M, Nguyen S, Flamant C, Roze JC, Gascoin G
BJOG. 2016 Nov;123(12):1956-1963. doi: 10.1111/1471-0528.14177. Epub 2016 Jul 18. BJOG. 2016 Nov; 123(12) :1964.
Comment on JAMA Pediatr. 2014 Feb;168(2):137-47. Am J Obstet Gynecol. 2004 Jan;190(1):147-51. Obstet Gynecol. 2016 Mar;127(3):437-41. Arch Dis Child Fetal Neonatal Ed. 2009 Jan;94(1):F13-6.

OBJECTIVE: The objective of our study was to identify placental patterns associated with death before discharge or cerebral palsy in a large cohort of preterm infants with a high follow-up rate at 2 years of corrected age.
DESIGN: Population-based monocentric study.
SETTINGS: Monocentric study in the maternity unit of the University Hospital of Angers, France between 24(+0) and 33(+6) weeks of gestation, between January 2008 and December 2011.
POPULATION: All singleton infants born alive with a placental examination were eligible.
METHODS: Clinical data (obstetric and neonatal) were collected prospectively through the LIFT cohort. Placental data were collected retrospectively from medical records. The main outcome measure was death before discharge or cerebral palsy.
RESULTS: We did not find any significant association between severe inflammatory lesions on the placenta and death [odds ratio (OR) 1.49; 95% CI 0.55-4.01; P = 0.43] or cerebral palsy (OR 1.41; 95% CI 0.43-4.62; P = 0.57). This lack of significant association persisted even after adjustment (aOR 0.9; 95% CI 0.20-2.30; P = 0.54; aOR 0.98; 95% CI 0.27-3.58; P = 0.97).
CONCLUSION: Our results do not provide evidence for a significant association between severe inflammatory placental lesions and either death before discharge or cerebral palsy at 2 years of corrected age in preterm infants born at <34 weeks of gestational age. Further studies remain necessary to confirm this result.
TWEETABLE ABSTRACT: We found no significant association between inflammatory placental lesions and death or cerebral palsy.

DOI: 10.1111/1471-0528.14177

PMID: 27428037 [PubMed - indexed for MEDLINE]

Congenital Cytomegalovirus among Children with Cerebral Palsy.
Smithers-Sheedy H, Raynes-Greenow C, Badawi N, Fernandez MA, Kesson A, McIntyre S, Leung KC, Jones CA
J Pediatr. 2016 Nov 3. pii: S0022-3476(16)31092-7. doi: 10.1016/j.jpeds.2016.10.024. [Epub ahead of print]

OBJECTIVES: To determine the proportion of children with cerebral palsy (CP) and cytomegalovirus (CMV) DNA detected retrospectively in their newborn screening cards (NBSC), to compare the proportion of children with CMV DNA in their NBSC across spastic subtypes of CP, and to compare the sex and other characteristics of children with CP and CMV detected on their NSBC with those in whom CMV DNA was not detected.
STUDY DESIGN: Retrospective observational study. Data were extracted from patient records on children with CP (birth years 1996-2014) from 2 Australian state CP registers and state-wide paediatric rehabilitation services with consent. NBSCs were retrospectively analyzed for CMV DNA by nested polymerase chain reaction (PCR) using primers against gB. Positive samples were validated using real time PCR for CMV UL83.
RESULTS: Of 401 children recruited, 323 (80.5%) had an available NBSC. Of these, 31 (9.6%; 95% CI, 6.8-13.3) tested positive for CMV DNA by nested PCR for CMV gB, of whom 28 (8.7%; 95% CI, 6.1-12.2) also had CMV DNA detected by real-time PCR for CMV UL83. Detection of CMV DNA was significantly associated with epilepsy, but not with clinical or epidemiologic characteristics, including sex and pattern of spasticity.
CONCLUSIONS: CMV viremia in the newborn period, indicating congenital CMV infection, is highly prevalent among children with CP. Further research is needed to investigate the mechanisms and contribution of congenital CMV to the causal pathways to CP.

DOI: 10.1016/j.jpeds.2016.10.024
PMID: 27816221 [PubMed - as supplied by publisher]

Early neurodevelopmental outcomes of extremely preterm infants.
Rogers EE, Hintz SR
Semin Perinatol. 2016 Nov 16. pii: S0146-0005(16)30074-X. doi: 10.1053/j.semperi.2016.09.002. [Epub ahead of print]

Infants born at extreme preterm gestation are at risk for both death and disability. Although rates of survival have improved for this population, and some evidence suggests a trend toward decreased neuromotor impairment over the past decades, a significant improvement in overall early neurodevelopmental outcome has not yet been realized. This review will examine the rates and types of neurodevelopmental impairment seen after extremely preterm birth, including neurosensory, motor, cognitive, and behavioral outcomes. We focus on early outcomes in the first 18-36 months of life, as the majority of large neonatal studies examining neurodevelopmental outcomes stop at this age. However, this early age is clearly just a first glimpse into lifetime outcomes; the neurodevelopmental effects of extreme prematurity may last through school age, adolescence, and beyond. Importantly, prematurity appears to be an independent risk factor for adverse development, but this population demonstrates considerable variability in the types and severity of impairments. Understanding both the nature and prevalence of neurodevelopmental impairment among extremely preterm infants is important because it can lead to targeted interventions that in turn may lead to improved outcomes.

DOI: 10.1053/j.semperi.2016.09.002
PMID: 27865437 [PubMed - as supplied by publisher]

Glutaric aciduria type 1 as a cause of dystonic cerebral palsy.
Mohamed S, Hamad MH, Hassan HH, Salih MA.
Saudi Med J. 2015 Nov;36(11):1354-7. doi: 10.15537/smj.2015.11.12132.

Glutaric aciduria type 1 (GA1) is an inherited inborn error of metabolism caused by a deficiency of the enzyme glutaryl Co-A dehydrogenase (GCDH). Here, we report a 14-month-old Saudi boy with GA1 who presented with severe dystonia and was mis-diagnosed as cerebral palsy (CP). He presented to our institute with encephalopathy following an episode of gastroenteritis. His physical examination showed dystonia and spastic quadriplegia. His

investigations revealed elevated both urinary 3-hydroxy glutaric acid, and serum glutarylcarnitine. The DNA analysis confirmed homozygosity for a mutation in the GCDH-coding gene (c.482G greater than A; p.R161Q). This case alerts pediatricians to consider GA1 as a differential diagnosis of children presenting with dystonic CP.

Free PMC Article
DOI: 10.15537/smj.2015.11.12132
PMCID: PMC4673376
PMID: 26593172 [PubMed - indexed for MEDLINE]

Intrapartum risk factors for neonatal encephalopathy leading to cerebral palsy in women without apparent sentinel events.

Yamada T, Cho K, Morikawa M, Yamada T, Minakami H

J Obstet Gynaecol Res. 2015 Oct;41(10):1520-5. doi: 10.1111/jog.12772. Epub 2015 Jul 14.

IM: To determine intrapartum factors associated with neonatal encephalopathy leading to cerebral palsy (NE-CP).
METHODS: A total of 70 NE-CP patients who fulfilled study criteria (cephalic singleton pregnancy with attempted vaginal delivery [AVD] at gestational week [GW] ≥36; intrapartum occurrence of non-reassuring fetal status without apparent cause following reassuring fetal status on admission; and development of NE-CP) were compared with 210 AVD controls who had 1- and 5-min Apgar score ≥8 matched for GW, maternal parity, and use of uterotonics. Suboptimal care was defined as delayed reaction due to misinterpretation of fetal heart rate (FHR) tracing, or inappropriate trial of instrumental delivery (TOID). Successful and failed TOID were defined as vaginal and cesarean delivery after TOID, respectively. The 210 controls were assumed not to have had suboptimal care.
RESULTS: The rates of successful (34% vs 12%) and failed TOID (11% vs 0.0%), cesarean section (34% vs 14%), suboptimal care (57% vs 0.0%), pregnancy-induced hypertension (11% vs 2.4%), birthweight ≥3800 g (8.6% vs 1.9%), subgaleal hemorrhage (16% vs 0.0%) were significantly higher in NE-CP patients than in controls. Selection with the stepwise method and logistic regression analysis identified four independent risk factors for NE-CP: suboptimal intrapartum care (OR, 2.21; 95%CI: 1.99-2.47), cesarean section (OR, 1.19; 95%CI: 1.08-1.31), successful TOID (OR, 1.14; 95%CI: 1.03-1.25), and hypertension (OR, 1.20; 95%CI: 1.01-1.42).
CONCLUSIONS: Training programs for improved interpretation of FHR tracing and appropriate TOID are required to prevent NE-CP among healthy and mature fetuses in Japan.

DOI: 10.1111/jog.12772
PMID: 26178588 [PubMed - indexed for MEDLINE]

Maternal Infections During Pregnancy and Cerebral Palsy in the Child.

Bear JJ(1), Wu YW(2).

Pediatr Neurol. 2016 Apr;57:74-9. doi: 10.1016/j.pediatrneurol.2015.12.018. Epub 2016 Jan 7.

BACKGROUND: Chorioamnionitis is a risk factor for cerebral palsy. The relationship between extra-amniotic infections and cerebral palsy is less well studied. We examined maternal intra-amniotic and extra-amniotic infections and risk of cerebral palsy in the child.
METHODS: Among a retrospective cohort of 6 million Californian births, 1991-2001, we analyzed administrative maternal and newborn hospital discharge abstracts linked to records of all children receiving services for cerebral palsy at the California Department of Developmental Services. We identified maternal hospital diagnoses of intra-amniotic (chorioamnionitis) and extra-amniotic (other genitourinary and respiratory) infections occurring up to 12 months before delivery. Using multivariable logistic regression, we determined the independent association between maternal infections and cerebral palsy, adjusting for infant sex, maternal age, race, education, socioeconomic status, and obesity.
RESULTS: About 5.5% of mothers had a hospital discharge diagnosis of at least one of the following: chorioamnionitis (2.0%), other genitourinary (3.1%), and respiratory infection (0.6%). An infection diagnosis was more common in mothers of the 8473 infants with cerebral palsy than in mothers of unaffected children (13.7% vs 5.5%, $P < 0.001$). All three types of maternal infections (chorioamnionitis, odds ratio [OR] 3.1, 95% confidence interval [CI] 2.9-3.4; other genitourinary infection, OR 1.4, 95% CI 1.3-1.6; and respiratory infection, OR 1.9, 95% CI 1.5-2.2) were associated with cerebral palsy in multivariable analyses. Maternal extra-amniotic infections, whether diagnosed during prenatal or birth hospitalizations, conferred an increased risk of cerebral palsy.

CONCLUSIONS: Maternal extra-amniotic infections diagnosed in the hospital during pregnancy are associated with a modestly increased risk of cerebral palsy in the child.

DOI: 10.1016/j.pediatrneurol.2015.12.018
PMCID: PMC4801683 [Available on 2017-04-01]
PMID: 26857522 [PubMed - indexed for MEDLINE

Outcome of infants with hypoxic ischemic encephalopathy treated with brain hypothermia.
Tokuhisa T, Ibara S, Minakami H, Maede Y, Ishihara C, Matsui T.
J Obstet Gynaecol Res. 2015 Feb;41(2):229-37. doi: 10.1111/jog.12520. Epub 2014 Oct 27.

AIM: The aim of this study was to determine perinatal factors associated with cerebral palsy (CP) in infants treated with brain hypothermia (BHT).
MATERIAL AND METHODS: We carried out a retrospective review of 23 infants with hypoxic ischemic encephalopathy in whom BHT was applied within 6 h after birth. Outcome regarding the presence or absence of CP was assessed at the age of 18 months. Oxygen extraction fraction (OEF) was measured before, during and after BHT at the jugular sinus.
RESULTS: Three infants died and 12 developed CP (poor outcome group). The remaining eight infants did not have CP at 18 months old (favorable outcome group). There were no differences in gestational age, birthweight, pH, base deficit, or lactate level between infants with favorable and poor outcomes. Infants with flat trace on electroencephalography on admission were less likely to have favorable outcome (0.0% [0/8] vs 53% [8/15], respectively, P = 0.02), while those with Apgar score at 10 min ≥5 (57% [8/14] vs 0.0% [0/9], P = 0.007) or ≥6 (70% [7/10] vs 7.7% [1/13], P = 0.002), OEF ≥ 13.3% during BHT (64% [7/11] vs 8.3% [1/12], P = 0.009), and OEF ≥ 18.5% after BHT (73% [8/11] vs 0.0% [0/12], P = 0.002) were more likely to have favorable outcome compared with those with counterpart characteristics.
CONCLUSION: Infants with an Apgar score at 10 min ≥5, activity on electroencephalography on admission, and higher OEF during and after BHT were likely to have a favorable outcome.

DOI: 10.1111/jog.12520
PMID: 25346401 [PubMed - indexed for MEDLINE]

Preterm Hypoxic-Ischemic Encephalopathy.
Gopagondanahalli KR, Li J, Fahey MC, Hunt RW, Jenkin G, Miller SL, Malhotra A
Front Pediatr. 2016 Oct 20;4:114. eCollection 2016.

Hypoxic-ischemic encephalopathy (HIE) is a recognizable and defined clinical syndrome in term infants that results from a severe or prolonged hypoxic-ischemic episode before or during birth. However, in the preterm infant, defining hypoxic-ischemic injury (HII), its clinical course, monitoring, and outcomes remains complex. Few studies examine preterm HIE, and these are heterogeneous, with variable inclusion criteria and outcomes reported. We examine the available evidence that implies that the incidence of hypoxic-ischemic insult in preterm infants is probably higher than recognized and follows a more complex clinical course, with higher rates of adverse neurological outcomes, compared to term infants. This review aims to elucidate the causes and consequences of preterm hypoxia-ischemia, the subsequent clinical encephalopathy syndrome, diagnostic tools, and outcomes. Finally, we suggest a uniform definition for preterm HIE that may help in identifying infants most at risk of adverse outcomes and amenable to neuroprotective therapies.
Free PMC Article
DOI: 10.3389/fped.2016.00114
PMCID: PMC5071348
PMID: 27812521 [PubMed - in process]

Risk of neonatal and childhood morbidity among preterm infants exposed to marijuana.
Dotters-Katz SK, Smid MC, Manuck TA, Metz TD
J Matern Fetal Neonatal Med. 2016 Dec 6:1-19. [Epub ahead of print]

BACKGROUND: Limited data exist regarding the neonatal and neurodevelopmental outcomes of infants exposed to marijuana (MJ) in-utero, particularly among preterm infants. We hypothesized that MJ-exposed preterm infants would have worse neonatal and childhood developmental outcomes compared to MJ-unexposed infants.
METHODS: Secondary analysis of multicenter randomized-controlled trial of antenatal magnesium sulfate for prevention of cerebral palsy was conducted. Singleton non-anomalous infants delivered <35 weeks exposed to MJ in-utero were compared to MJ-unexposed. Primary neonatal outcome was death, grade ¾ intraventricular hemorrhage, periventricular leukomalacia, bronchopulmonary dysplasia, and/or stage II/III necrotizing enterocolitis before discharge. Primary childhood outcome was death, moderate/severe cerebral palsy, or/and Bayley II Scales <70 at age 2. Backwards-stepwise regression used to estimate odds of primary outcomes.
RESULTS: 1,867 infants met inclusion criteria; 135(7.2%) were MJ-exposed. There were no differences in neonatal (20%vs26%, p = 0.14) or childhood (26%vs21%, p = 0.21) outcomes in MJ-exposed infants compared to MJ-unexposed infants. In adjusted models, MJ-exposure was not associated with adverse neonatal outcomes (aOR 0.83 95%CI 0.47,1.44) or early childhood outcomes (aOR 1.47, 95%CI 0.97,2.23).
CONCLUSIONS: Among infants born <35 weeks of gestation, MJ-exposure was not associated with adverse neonatal or childhood outcomes. Long-term follow up studies are needed to assess later childhood neurodevelopmental outcomes following MJ-exposure.
DOI: 10.1080/14767058.2016.1269165
PMID: 27921445 [PubMed - as supplied by publisher]

SGA as a Risk Factor for Cerebral Palsy in Moderate to Late Preterm Infants: a System Review and Meta-analysis.
Zhao M, Dai H, Deng Y, Zhao L
Sci Rep. 2016 Dec 13;6:38853. doi: 10.1038/srep38853.

Small for gestational age (SGA) is an established risk factor for cerebral palsy (CP) in term infants. However, there is conflicting data on the association between SGA and CP in moderate to late preterm infants. The aim of the article was to explore the relationship between SGA and CP in the moderate to late preterm infants and its strength by meta-analysis. We performed a system search in OVID (EMBASE and MEDLINE) and WANFANG from inception to May 2016. The study-specific risk estimates were pooled using the random-effect model. A total of seven studies were included in the meta-analysis, consisting of three cohort and four case-control studies. A statistically significant association was found between SGA and CP in moderate to late premature infants (OR: 2.34; 95% CI: 1.43-3.82). The association were higher in the several subgroups: 34-36 week gestational age (OR: 3.47; 95% CI: 1.29-9.31), SGA < 2SDs (OR: 3.48; 95% CI: 1.86-6.49), and malformation included in CP (OR: 3.00; 95% CI: 1.71-5.26). In moderate to late premature infants, SGA is a convenient and reliable predictor for CP. More studies are needed to explore the underlying mechanisms between SGA and CP association.
Free Article
DOI: 10.1038/srep38853
PMID: 27958310 [PubMed - in process]

The association between antioxidant enzyme polymorphisms and cerebral palsy after perinatal hypoxic-ischaemic encephalopathy.
Esih K, Goričar K, Dolžan V, Rener-Primec Z
Eur J Paediatr Neurol. 2016 Sep;20(5):704-8. doi: 10.1016/j.ejpn.2016.05.018. Epub 2016 Jun 2.

BACKGROUND: Hypoxic-ischaemic perinatal brain injury leads to the formation of reactive oxygen species (ROS) and the resultant cell and tissue damage may cause neurological sequelae such as cerebral palsy and/or epilepsy. A decrease in the capacity for defending against ROS may increase the susceptibility to cerebral palsy. The aim of this study was to investigate the impact of common functional polymorphisms in the antioxidant genes SOD2, GPX1 and CAT, associated with a decreased capacity for defending against ROS, in patients with perinatal hypoxic-ischaemic encephalopathy (HIE).
METHODS: 80 patients previously diagnosed with perinatal HIE were included. Genomic DNA was isolated from buccal swabs and genotyped for SOD2 rs4880, GPX1 rs1050450 and CAT rs1001179 using real-time PCR-based methods.

RESULTS: Among patients with neonatal HIE, carriers of at least one polymorphic CAT rs1001179 T allele were significantly associated with development of cerebral palsy compared to non-carriers (univariate logistic regression, p = 0.026; OR = 3.36; 95% CI = 1.16-9.76). This difference remained statistically significant after accounting for prematurity. The investigated SOD2 and GPX1 polymorphisms were not associated with cerebral palsy after perinatal HIE.
CONCLUSION: CAT rs1001179 polymorphism could be used to identify children that have a higher susceptibility to cerebral palsy after perinatal HIE.

DOI: 10.1016/j.ejpn.2016.05.018
PMID: 27302388 [PubMed - indexed for MEDLINE]

Génétique

Mutations in SLC5A6 associated with brain, immune, bone, and intestinal dysfunction in a young child.
Subramanian VS(1,)(2), Constantinescu AR(3), Benke PJ(4), Said HM(5,)(6,)(7).
Hum Genet. 2016 Nov 30. [Epub ahead of print]

The human sodium-dependent multivitamin transporter (hSMVT) is a product of the SLC5A6 gene and mediates biotin, pantothenic acid, and lipoate uptake in a variety of cellular systems. We report here the identification of mutations R94X, a premature termination, and R123L, a dysfunctional amino acid change, both in exon 3 of the SLC5A6 gene in a child using whole genome-scanning. At 15 months of age, the child showed failure to thrive, microcephaly and brain changes on MRI, cerebral palsy and developmental delay, variable immunodeficiency, and severe gastro-esophageal reflux requiring a gastrostomy tube/fundoplication, osteoporosis, and pathologic bone fractures. After identification of the SLC5A6 mutations, he responded clinically to supplemental administration of excess biotin, pantothenic acid, and lipoate with improvement in clinical findings. Functionality of the two mutants was examined by (3)H-biotin uptake assay following expression of the mutants in human-derived intestinal HuTu-80 and brain U87 cells. The results showed severe impairment in biotin uptake in cells expressing the mutants compared to those expressing wild-type hSMVT. Live cell confocal imaging of cells expressing the mutants showed the R94X mutant to be poorly tolerated and localized in the cytoplasm, while the R123L mutant was predominantly retained in the endoplasmic reticulum. This is the first reporting of mutations in the SLC5A6 gene in man, and suggests that this gene is important for brain development and a wide variety of clinical functions.
DOI: 10.1007/s00439-016-1751-x
PMID: 27904971 [PubMed - as supplied by publisher]

Lésions - Prévention des lesions

Données fondamentales

A Battery of Motor Tests in a Neonatal Mouse Model of Cerebral Palsy.
Feather-Schussler DN, Ferguson TS.
J Vis Exp. 2016 Nov 3;(117). doi: 10.3791/53569.

As the sheer number of transgenic mice strains grow and rodent models of pediatric disease increase, there is an expanding need for a comprehensive, standardized battery of neonatal mouse motor tests. These tests can validate injury or disease models, determine treatment efficacy and/or assess motor behaviors in new transgenic strains. This paper presents a series of neonatal motor tests to evaluate general motor function, including ambulation, hindlimb foot angle, surface righting, negative geotaxis, front- and hindlimb suspension, grasping reflex, four limb grip strength and cliff aversion. Mice between the ages of post-natal day 2 to 14 can be used. In addition, these tests can be used for a wide range of neurological and neuromuscular pathologies, including cerebral palsy, hypoxic-ischemic encephalopathy, traumatic brain injury, spinal cord injury, neurodegenerative diseases, and neuromuscular disorders. These tests can also be used to determine the effects of pharmacological agents, as well as other types of therapeutic interventions. In this paper, motor deficits were evaluated in a novel neonatal mouse model of cerebral palsy that combines hypoxia, ischemia and inflammation. Forty-eight hours after injury, five tests out of the nine showed significant motor deficits: ambulation, hindlimb angle, hindlimb suspension, four limb grip strength, and

grasping reflex. These tests revealed weakness in the hindlimbs, as well as fine motor skills such as grasping, which are similar to the motor deficits seen in human cerebral palsy patients.
DOI: 10.3791/53569
PMID: 27842358 [PubMed - in process]

Données cliniques

A magnetic resonance imaging finding in children with cerebral palsy: Symmetrical central tegmental tract hyperintensity.

Derinkuyu BE, Ozmen E, Akmaz-Unlu H, Altinbas NK, Gurkas E, Boyunaga O
Brain Dev. 2016 Nov 11. pii: S0387-7604(16)30173-5. doi: 10.1016/j.braindev.2016.10.004. [Epub ahead of print]

BACKGROUND: Central tegmental tract is an extrapyramidal tract between red nucleus and inferior olivary nucleus which is located in the tegmentum pontis bilaterally and symmetrically. The etiology of the presence of central tegmental tract hyperintensity on MRI is unclear.
PURPOSE: In this study our aim is to evaluate the frequency of central tegmental tract lesions in patients with cerebral palsy and control group, as well as to determine whether there is an association between central tegmental tract lesions and cerebral palsy types.
MATERIALS AND METHODS: Clinical and MRI data of 200 patients with cerebral palsy in study group (87 female, 113 male; mean age, 5.81years; range, 0-16years) and 258 patients in control group (114 female, 144 male; mean age, 6.28years; range, 0-16years) were independently evaluated by two reader for presence of central tegmental tract hyperintensity and other associated abnormalities.
RESULTS: Central tegmental tract hyperintensities on T2WI were detected in 19% of the study group (38/200) and 3.5% of the control group (9/258) (p<0.0001). Among the total of 38 central tegmental tract lesions in study group, the frequency of central tegmental tract hyperintensity was 16% (24/150) in spastic cerebral palsy and 35% (14/40) in dyskinetic cerebral palsy (p=0.0131).
CONCLUSION: The prevalence of central tegmental tract hyperintensity is higher in patients with cerebral palsy particularly in dyskinetic type. We suggest that there is an increased association of the tegmental lesions with dyskinetic CP. Patients with cerebral palsy and ischemic changes were more likely to have central tegmental tract lesions. According to our results we advocate that an ischemic process may have a role in the etiopathogenesis.

DOI: 10.1016/j.braindev.2016.10.004
PMID: 27843044 [PubMed - as supplied by publisher]

Antenatal magnesium sulfate and neurodevelopmental outcome of preterm infants born to preeclamptic mothers.

Bozkurt O, Eras Z, Canpolat FE, Oguz SS, Uras N, Dilmen U
J Matern Fetal Neonatal Med. 2016;29(7):1101-4. doi: 10.3109/14767058.2015.1035641. Epub 2015 Apr 20.

OBJECTIVE: Previous studies demonstrated that magnesium sulfate is associated with better neurological outcome and decreased cerebral palsy rates in preterm newborns. The aim of this study is to assess the effects of antenatal magnesium sulfate on neurodevelopmental outcomes of preterm infants.
METHODS: Preterm newborns with a gestational age of <32 weeks whose mothers were diagnosed with preeclampsia were extracted from the hospital records and files retrospectively. The neurodevelopmental assessment was performed at 2 years of age by developmental pediatrician. The results of the infants exposed to antenatal magnesium sulfate were compared with the control group.
RESULTS: Between the years 2010 and 2012, 387 preterm babies were born to preeclamptic mothers. Fifty-nine (15.2%) of them were exposed to antenatal magnesium sulfate. The main clinical characteristics did not differ between the groups. On the other hand, cerebral palsy was significantly lower in preterm infants exposed to magnesium sulfate compared to the control group (3.3% and 12.2%, respectively, p = 0.004). On multinominal logistic regression analysis, magnesium sulfate was not an independent significant factor to reduce CP on its own.

CONCLUSION: Antenatal magnesium sulfate can be used as a neuroprotective strategy especially for the prevention of cerebral palsy in preterm infants. Future studies should be designed to support the positive effect of antenatal magnesium sulfate on neurologic development.
DOI: 10.3109/14767058.2015.1035641
PMID: 25893546 [PubMed - indexed for MEDLINE]

Antepartum and intrapartum interventions to prevent preterm birth and its sequelae.
Nijman TA, van Vliet EO, Koullali B, Mol BW, Oudijk MA
Semin Fetal Neonatal Med. 2016 Apr;21(2):121-8. doi: 10.1016/j.siny.2016.01.004. Epub 2016 Feb 11.

Preterm birth is the main cause of neonatal morbidity and mortality. This review provides an overview of antepartum and intrapartum management of threatened preterm birth. The most effective method to identify women at high risk of delivering within seven days is the combination of cervical length and fetal fibronectin test. Antenatal corticosteroids administered for 48 h improve neonatal outcome. Although tocolysis has been shown to prolong pregnancy, there is no evidence that tocolytic therapy improves neonatal outcomes. Intrapartum administration of magnesium sulfate improves neurologic outcomes, such as cerebral palsy and gross motor function. In women with preterm premature rupture of membranes, prophylactic antibiotic treatment with erythromycin improves short-term neonatal outcomes, but proof of long-term benefit is lacking. In threatened preterm birth with intact membranes, prophylactic antibiotic treatment is thought to be harmful. Critical appraisal of the long-term benefits and harms of all these treatments questions their use.

DOI: 10.1016/j.siny.2016.01.004
PMID: 26875954 [PubMed - indexed for MEDLINE]

Caffeine for apnea of prematurity: Effects on the developing brain.
Atik A, Harding R, De Matteo R, Kondos-Devcic D, Cheong J, Doyle LW, Tolcos M.
Neurotoxicology. 2016 Nov 27;58:94-102. doi: 10.1016/j.neuro.2016.11.012.

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 benefical 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.

DOI: 10.1016/j.neuro.2016.11.012
PMID: 27899304 [PubMed - as supplied by publisher]

[Can caesarean delivery prevent cerebral palsy? Medico-legal implications of a French ecological study].
[Article in French]
Racinet C, Tronc C, Sellier E, Cans C, van Bakel ME.
Gynecol Obstet Fertil. 2015 Jan;43(1):8-12. doi: 10.1016/j.gyobfe.2014.11.007. Epub 2014 Dec 9.
Comment in Gynecol Obstet Fertil. 2015 May;43(5):412-3. Gynecol Obstet Fertil. 2015 May;43(5):413-4.

OBJECTIVE: For a long time, the benefit of a caesarean delivery in the prevention of cerebral palsy (CP) has been put forward, which was based on the assumption that CP is due to asphyxia in more than 50 % of the cases. However, from register-based data, this rate has been estimated less than 4 %. The aim of this study was to evaluate whether the rate of caesarean sections for fetal indication was correlated with the prevalence rate of CP in a French county.
PATIENTS AND METHODS: This was an ecological study of register-based prevalence estimates of children with CP (postnatal cases excluded) born between 1997 and 2003 in a French county compared with the rates of caesarean section for fetal distress obtained from the maternal and infant protection service of the county.
RESULTS: Whilst the rate of caesarean section for fetal indication increased by 44% during the period studied, the prevalence of CP remained nearly stable around 1.5 per 1000 live births. There was no correlation between caesarean section and CP prevalence (r'=-0.36, P=0.43).
DISCUSSION AND CONCLUSION: The present study was in accordance with the results of a recent meta-analysis which concluded that emergency and prophylactic caesarean deliveries were not efficient in the prevention of CP. Indication of caesarean delivery for foetal heart rhythm anomaly, which is the most relevant cause for the growing rate of caesarean sections, should be justified by additional examinations in ambivalent cases, in order not to consider it as defensive medicine, which is ethically and therefore juridically blameworthy.

DOI: 10.1016/j.gyobfe.2014.11.007
PMID: 25497386 [PubMed - indexed for MEDLINE]

Corticostriatal connectivity fingerprints: Probability maps based on resting-state functional connectivity.
Jaspers E, Balsters JH, Kassraian Fard P, Mantini D, Wenderoth N
Hum Brain Mapp. 2016 Nov 12. doi: 10.1002/hbm.23466.

Over the last decade, structure-function relationships have begun to encompass networks of brain areas rather than individual structures. For example, corticostriatal circuits have been associated with sensorimotor, limbic, and cognitive information processing, and damage to these circuits has been shown to produce unique behavioral outcomes in Autism, Parkinson's Disease, Schizophrenia and healthy ageing. However, it remains an open question how abnormal or absent connectivity can be detected at the individual level. Here, we provide a method for clustering gross morphological structures into subregions with unique functional connectivity fingerprints, and generate network probability maps usable as a baseline to compare individual cases against. We used connectivity metrics derived from resting-state fMRI (N = 100), in conjunction with hierarchical clustering methods, to parcellate the striatum into functionally distinct clusters. We identified three highly reproducible striatal subregions, across both hemispheres and in an independent replication dataset (N = 100) (dice-similarity values 0.40-1.00). Each striatal seed region resulted in a highly reproducible distinct connectivity fingerprint: the putamen showed predominant connectivity with cortical and cerebellar sensorimotor and language processing areas; the ventromedial striatum cluster had a distinct limbic connectivity pattern; the caudate showed predominant connectivity with the thalamus, frontal and occipital areas, and the cerebellum. Our corticostriatal probability maps agree with existing connectivity data in humans and non-human primates, and showed a high degree of replication. We believe that these maps offer an efficient tool to further advance hypothesis driven research and provide important guidance when investigating deviant connectivity in neurological patient populations suffering from e.g., stroke or cerebral palsy. Hum Brain
Mapp, 2016.
DOI: 10.1002/hbm.23466
PMID: 27859903 [PubMed - as supplied by publisher]

Less severe cerebral palsy outcomes in infants treated with therapeutic hypothermia.
Jary S, Smit E, Liu X, Cowan FM, Thoresen M
Acta Paediatr. 2015 Dec;104(12):1241-7. doi: 10.1111/apa.13146. Epub 2015 Oct 15.

AIM: To describe the incidence, type and severity of cerebral palsy at 24 months in a regional cohort of infants treated with whole-body therapeutic hypothermia for neonatal encephalopathy.
METHODS: Data were collected prospectively in a regional centre providing TH. Antenatal and perinatal clinical variables and severity of encephalopathy were collected. Infants were assessed at 18 months using the Bayley Scales of Infant and Toddler Development-III, and the presence and severity of CP was investigated at 24 months.

RESULTS: A total of 125 of 132 infants fulfilled entry criteria for TH trials and completed 72 h of TH. Sixteen (13%) of the 125 infants died, and eight (6%) were not available for follow-up. Eighteen infants (14%; 18% of those assessed) developed CP. Of these, 12 (67%) were classified using the Gross Motor Function Classification System, at level 1, six (33%) at level 5 and none at levels 2, 3 or 4.
CONCLUSION: Our regional clinical cohort had lower mortality and comparable rates of CP compared with historical outcomes in TH trials. In contrast to historical cohorts, only one-third of the 18 children with CP were severely affected and 12 were mildly affected, all of whom were independently ambulant by 24 months.
 DOI: 10.1111/apa.13146
PMID: 26237284 [PubMed - indexed for MEDLINE]

Pathogenesis of cerebral palsy through the prism of immune regulation of nervous tissue homeostasis: literature review.

Lisovska N, Daribayev Z, Lisovskyy Y, Kussainova K, Austin L, Bulekbayeva S
Childs Nerv Syst. 2016 Nov;32(11):2111-2117. Epub 2016 Sep 14.

BACKGROUND: The cerebral palsy is highly actual issue of pediatrics, causing significant neurological disability. Though the great progress in the neuroscience has been recently achieved, the pathogenesis of cerebral palsy is still poorly understood.
METHODS: In this work, we reviewed available experimental and clinical data concerning the role of immune cells in pathogenesis of cerebral palsy. Maintaining of homeostasis in nervous tissue and its transformation in case of periventricular leukomalacia were analyzed.
RESULTS: The reviewed data demonstrate involvement of immune regulatory cells in the formation of nervous tissue imbalance and chronicity of inborn brain damage. The supported opinion, that periventricular leukomalacia is not a static phenomenon, but developing process, encourages our optimism about the possibility of its correction.
CONCLUSIONS: The further studies of changes of the nervous and immune systems in cerebral palsy are needed to create fundamentally new directions of the specific therapy and individual schemes of rehabilitation.
DOI: 10.1007/s00381-016-3245-5
PMID: 27638717 [PubMed - in process]

Relationship between somatosensory deficit and brain somatosensory system after early brain lesion: A morphometric study.

Perivier M, Delion M, Chinier E, Loustau S, Nguyen S, Ter Minassian A, Richard I, Dinomais M.
Eur J Paediatr Neurol. 2016 May;20(3):403-11. doi: 10.1016/j.ejpn.2015.11.013. Epub 2016 Jan 19.

Cerebral Palsy (CP) is a group of permanent motor disorders due to non-progressive damage to the developing brain. Poor tactile discrimination is common in children with unilateral CP. Previous findings suggest the crucial role areas located in the ipsilesional hemisphere for somatosensory function processing. However, no focus on the relationship between structural characteristics of ipsilesional S1 and S2 and tactile discrimination function in paretic hands has been proposed. Using structural MRI and a two-point discrimination assessment (2 PD), we explore this potential link in a group of 21 children (mean age 13 years and 7 months) with unilateral CP secondary to a periventricular white matter injury (PWMI) or middle cerebral artery infarct (MCA). For our whole sample there was a significant negative correlation between the 2 PD and the gray matter volume in the ipsilesional S2 (rho = -0.50 95% confidence interval [-0.76, -0.08], one-tailed p-value = 0.0109) and in the ipsilesional S1 (rho = -0.57, 95% confidence interval [-0.81, -0.19], one-tailed p-value = 0.0032). When studying these relationships with regard to the lesion types, we found these correlations were non-significant in the patients with PWMI but stronger in patients with MCA. According to our results, the degree of sensory impairment is related to the spared gray matter volume in ipsilesional S1 and S2 and is marked after an MCA stroke. Our work contributes to a better understanding of why some patients with CP have variable somatosensory deficit following an early brain lesion.

DOI: 10.1016/j.ejpn.2015.11.013
PMID: 26831357 [PubMed - indexed for MEDLINE]

The Effects of the Severity of Periventricular Leukomalacia on the Neuropsychological Outcomes of Preterm Children.

Choi JY, Rha DW, Park ES
J Child Neurol. 2016 Apr;31(5):603-12. doi: 10.1177/0883073815604229. Epub 2015 Sep 18.

This study investigates the developmental outcomes of preterm children according to severity of periventricular leukomalacia. One hundred preterm children with periventricular leukomalacia evident on brain magnetic resonance imaging and who had undergone neuropsychologic evaluation were selected. Intellectual disability was noted in 27.8% of the children with mild periventricular leukomalacia, 53.2% with moderate periventricular leukomalacia, and 77.1% with severe periventricular leukomalacia. The rates of major neurodevelopmental impairments such as cerebral palsy or intellectual disability were related to the severity of periventricular leukomalacia but not to gestational age or epilepsy. There were significant differences in the intelligence quotient (IQ) and social maturity quotient between 3 groups of periventricular leukomalacia. The performance IQ was significantly lower than the verbal IQ. Behavioral problems were noted in about one-third of the children but the rate was not related with the severity of periventricular leukomalacia. Our study revealed the significant associations between severity of periventricular leukomalacia and cognitive and social adaptive functions in the preterm children.

DOI: 10.1177/0883073815604229
PMID: 26385973 [PubMed - indexed for MEDLINE]

White Matter Injury and General Movements in High-Risk Preterm Infants.
Peyton C, Yang E, Msall ME, Adde L, Støen R, Fjørtoft T, Bos AF, Einspieler C, Zhou Y, Schreiber MD, Marks JD, Drobyshevsky A.
AJNR Am J Neuroradiol. 2016 Oct 27. [Epub ahead of print]

BACKGROUND AND PURPOSE: Very preterm infants (birth weight, <1500 g) are at increased risk of cognitive and motor impairment, including cerebral palsy. These adverse neurodevelopmental outcomes are associated with white matter abnormalities on MR imaging at term-equivalent age. Cerebral palsy has been predicted by analysis of spontaneous movements in the infant termed "General Movement Assessment." The goal of this study was to determine the utility of General Movement Assessment in predicting adverse cognitive, language, and motor outcomes in very preterm infants and to identify brain imaging markers associated with both adverse outcomes and aberrant general movements.
MATERIALS AND METHODS: In this prospective study of 47 preterm infants of 24-30 weeks' gestation, brain MR imaging was performed at term-equivalent age. Infants underwent T1- and T2-weighted imaging for volumetric analysis and DTI. General movements were assessed at 10-15 weeks' postterm age, and neurodevelopmental outcomes were evaluated at 2 years by using the Bayley Scales of Infant and Toddler Development III.
RESULTS: Nine infants had aberrant general movements and were more likely to have adverse neurodevelopmental outcomes, compared with infants with normal movements. In infants with aberrant movements, Tract-Based Spatial Statistics analysis identified significantly lower fractional anisotropy in widespread white matter tracts, including the corpus callosum, inferior longitudinal and fronto-occipital fasciculi, internal capsule, and optic radiation. The subset of infants having both aberrant movements and abnormal neurodevelopmental outcomes in cognitive, language, and motor skills had significantly lower fractional anisotropy in specific brain regions.
CONCLUSIONS: Aberrant general movements at 10-15 weeks' postterm are associated with adverse neurodevelopmental outcomes and specific white matter microstructure abnormalities for cognitive, language, and motor delays.

DOI: 10.3174/ajnr.A4955
PMID: 27789448 [PubMed - as supplied by publisher]

Détection – Diagnostic

Données cliniques

Advanced neuroimaging and its role in predicting neurodevelopmental outcomes in very preterm infants.
Parikh NA

Semin Perinatol. 2016 Nov 15. pii: S0146-0005(16)30077-5. doi: 10.1053/j.semperi.2016.09.005.

Up to 35% of very preterm infants survive with neurodevelopmental impairments (NDI) such as cognitive deficits, cerebral palsy, and attention deficit disorder. Advanced MRI quantitative tools such as brain morphometry, diffusion MRI, magnetic resonance spectroscopy, and functional MRI at term-equivalent age are ideally suited to improve current efforts to predict later development of disabilities. This would facilitate application of targeted early intervention therapies during the first few years of life when neuroplasticity is optimal. A systematic search and review identified 47 published studies of advanced MRI to predict NDI. Diffusion MRI and morphometry studies were the most commonly studied modalities. Despite several limitations, studies clearly showed that brain structural and metabolite biomarkers are promising independent predictors of NDI. Large representative multicenter studies are needed to validate these studies.

DOI: 10.1053/j.semperi.2016.09.005
PMID: 27863706 [PubMed - as supplied by publisher]

Age at Referral of Children for Initial Diagnosis of Cerebral Palsy and Rehabilitation: Current Practices.
Hubermann L, Boychuck Z, Shevell M, Majnemer A
J Child Neurol. 2016 Mar;31(3):364-9. doi: 10.1177/0883073815596610. Epub 2015 Aug 3.

OBJECTIVES: This study describes current practices in the age at referral for diagnosis of cerebral palsy and factors that influence earlier referral.
STUDY DESIGN: Retrospective chart review (2002-2012).
RESULTS: Of 103 children referred for diagnosis, 81 were referred to a neurologist by other medical specialists at a mean of 13.6 ± 15.7 months, whereas primary care providers referred much later (mean = 28.8 ± 27.1 months). Children admitted to the neonatal intensive care unit were referred earlier (mean = 9.3 ± 10.2 months) than those not (28.1 ± 24.9 months). Referral to rehabilitation was similarly delayed.
CONCLUSIONS: Primary care providers generated a minority of referrals, of concern given their role in developmental surveillance. Remarkably high variability suggests knowledge of cerebral palsy attributes varies widely among service providers. Half of children with cerebral palsy do not have a complicated birth history; subsequently, referrals for diagnosis and management are often delayed. New strategies are needed to optimize prompt referral by primary care providers.

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PMID: 26239493 [PubMed - indexed for MEDLINE]

Development, and construct validity and internal consistency of the Grasp and Reach Assessment of Brisbane (GRAB) for infants with asymmetric brain injury.
Perez M, Ziviani J, Guzzetta A, Ware RS , Tealdi G, Burzi V, Boyd RN.
Infant Behav Dev. 2016 Nov;45(Pt A):110-123. doi: 10.1016/j.infbeh.2016.10.004. Epub 2016 Oct 27.

INTRODUCTION: Infants with asymmetric brain injury (asymBI) are at high risk of Unilateral Cerebral Palsy (UCP). The Grasp and Reach Assessment of Brisbane (GRAB) was developed to detect asymmetries in unimanual/bimanual upper limb (UL) reach and grasp behaviours in infants with asymBI. This study reports the development of the GRAB and evaluates its construct validity and internal consistency.
MATERIAL AND METHODS: Prospective study of twenty four infants with asymBI and twenty typically developing (TD) infants at 18 weeks corrected age (C.A.) in a structured play session. Three different coloured toys were presented at the midline in a block design of six 30-s trials of toy presentation, separated by five 30-s trials of no toy presentation. The number and duration of: (i) unimanual contacts; (ii) unimanual grasps; (iii) bimanual midline grasps; and (iv) duration of other unimanual behaviours (e.g. prehensile movements and transport phase) were measured. An Asymmetry Index (AI) was calculated to determine asymmetries between ULs. Possible AI values ranged from 0 to 100%, indicating proportion of toy presentation time that unimanual behaviours were asymmetric between ULs. Internal consistency of both the Time Phase (TP) and Toy Colour Phase (TCP) test items were determined by calculating Cronbach's alpha coefficients. Each assessment occasion was split into six TPs and two

TCPs; whereby one TP comprised one 30-s trial of one toy presentation and one TCP comprised two 30-s trials of the same toy presentation.
RESULTS: For TP, seven out of nine unimanual behaviours and two out of three bimanual behaviours demonstrated strong internal consistency (Cronbach's alpha coefficients 0.72-0.89). No unimanual activity demonstrated the strongest IC (0.89). For TCP, six out of nine unimanual behaviours demonstrated strong IC (0.73-0.82). Number of unimanual contacts and duration of unimanual prehensile movements demonstrated the strongest IC (0.82). Duration of unimanual contribution to hands at midline and duration of bimanual midline behaviour demonstrated the weakest IC for both TP and TCP (0.46-0.50). For unimanual contacts, the asymBI group were more asymmetric between ULs (mean AI=50%) compared to the TD group (mean AI=30%). For unimanual grasps, both groups were similarly asymmetric (both mean AI=40%). The TD group were almost twice as likely to demonstrate bimanual grasps as the asymBI group (incidence rate ratio IRR 1.9, 95% CI 1.4 to 2.5, p<0.001). Infants with asymBI were less likely to use the impaired UL compared to the unimpaired UL for grasping (IRR 0.6, 95% CI 0.5 to 0.8, p<0.001); and used the impaired UL for a shorter proportion of time compared to the unimpaired UL for grasping (mean difference -9.1%, 95% CI -16.6 to -1.7, p=0.02).
CONCLUSIONS: The GRAB is a criterion-referenced research measure that detects and quantifies the presence or absence of unimanual and bimanual reach and grasp behaviours at 18 weeks C.A. in infants at risk of UCP. The GRAB demonstrated moderate to strong construct validity and strong IC within an assessment occasion. There was no toy preference or warm-up effect for TP or TCP for either group; confirming that the GRAB is a consistent measure across toy presentations within an assessment occasion. In this study, the GRAB identified that infants with asymBI demonstrated a paucity of bimanual grasping compared to TD infants; and demonstrated asymmetric unimanual grasping between ULs at 18 weeks C.A.

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Early Cord Metabolite Index and Outcome in Perinatal Asphyxia and Hypoxic-Ischaemic Encephalopathy.
Ahearne CE, Denihan NM, Walsh BH, Reinke SN, Kenny LC, Boylan GB, Broadhurst DI, Murray DM.
Neonatology. 2016;110(4):296-302. Epub 2016 Aug 3.

BACKGROUND: A 1H-NMR-derived metabolomic index based on early umbilical cord blood alterations of succinate, glycerol, 3-hydroxybutyrate and O-phosphocholine has shown potential for the prediction of hypoxic-ischaemic encephalopathy (HIE) severity.
OBJECTIVE: To evaluate whether this metabolite score can predict 3-year neurodevelopmental outcome in infants with perinatal asphyxia and HIE, compared with current standard biochemical and clinical markers.
METHODS: From September 2009 to June 2011, infants at risk of perinatal asphyxia were recruited from a single maternity hospital. Cord blood was drawn and biobanked at delivery. Neonates were monitored for development of encephalopathy both clinically and electrographically. Neurodevelopmental outcome was assessed at 36-42 months using the Bayley Scales of Infant and Toddler Development, ed. III (BSID-III). Death and cerebral palsy were also considered as abnormal end
points.
RESULTS: Thirty-one infants had both metabolomic analysis and neurodevelopmental outcome at 36-42 months. No child had a severely abnormal BSID-III result. The metabolite index significantly correlated with outcome ($\rho 2 = 0.30$, $p < 0.01$), which is robust to predict both severe outcome (area under the receiver operating characteristic curve: 0.92, $p < 0.01$) and intact survival (0.80, $p = 0.01$). There was no correlation between the index score and performance in the individual BSID-III subscales (cognitive, language, motor).
CONCLUSIONS: The metabolite index outperformed other standard biochemical markers at birth for prediction of outcome at 3 years, but was not superior to EEG or the Sarnat score.

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PMID: 27486995 [PubMed - in process]

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

BACKGROUND: 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.
METHODS: 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.
RESULTS: 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.
CONCLUSIONS: 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.
Free Article
DOI: 10.1186/s13052-016-0309-9
PMID: 27906083 [PubMed - in process]

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.

PURPOSE: 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.
METHODS: 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.
RESULTS: 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.
CONCLUSION: 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.
Free PMC Article
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PMCID: PMC5118503
PMID: 27895691 [PubMed - in process]

Prognostic predictors for ambulation in children with cerebral palsy: a systematic review and meta-analysis of observational studies.
Keeratisiroj O, Thawinchai N, Siritaratiwat W, Buntragulpoontawee M, Pratoomsoot C.

Disabil Rehabil. 2016 Nov 16:1-9. [Epub ahead of print]

PURPOSE: The purpose of this study is to investigate the prognostic predictors for ambulation in children with cerebral palsy using meta-analysis of observational studies.
METHOD: Electronic searches were conducted in PubMed, SCOPUS, CINAHL, ProQuest, Ovid, Wiley InterScience, and ScienceDirect databases from their start dates to December 2015.
RESULTS: Of the 1123 identified articles, 12 met the inclusion criteria for qualitative synthesis, eight of which were deemed appropriate for meta-analysis. Qualitative synthesis found that the type of cerebral palsy, early motor milestones, primitive reflexes and postural reactions, absence of visual impairment, absence of intellectual disability, absence of epilepsy or seizure, and ability to feed self were indicated as potential predictors for ambulation. Meta-analysis detected four significant prognostic predictors for ambulation: sitting independently at 2 years, absence of visual impairment, absence of intellectual disability, and absence of epilepsy or seizure.
CONCLUSION: These prognostic predictors should be taken into consideration in therapeutic plans and rehabilitation goals, especially sitting independently before the age of 2 years. Implications for rehabilitation The meta-analysis supports strong evidence that sitting independently at 2 years of age, absence of visual impairment, absence of intellectual disability, and absence of epilepsy or seizure are positive predictors for ambulation in children with cerebral palsy. The therapeutic plans and rehabilitation goals should be considered cautiously for these predictors, especially sitting independently before the age of two years.
DOI: 10.1080/09638288.2016.1250119
PMID: 27848255 [PubMed - as supplied by publisher]

Sensitivity and specificity of General Movements Assessment for diagnostic accuracy of detecting cerebral palsy early in an Australian context.
Morgan C, Crowle C, Goyen TA, Hardman C, Jackman M, Novak I, Badawi N
J Paediatr Child Health. 2016 Jan;52(1):54-9. doi: 10.1111/jpc.12995. Epub 2015 Aug 19.

AIM: The aim of this study was to calculate the sensitivity and specificity of the General Movements Assessment (GMA) for estimating diagnostic accuracy in detecting cerebral palsy (CP) in an Australian context by a newly established NSW rater network.
METHODS: A prospective longitudinal cross-sectional study was conducted. The GMA was blind-rated from conventional video by two independent certified raters, blinded to medical history. A third rater resolved disagreements. High-risk population screening for CP using the GMA during the fidgety period (12-20 weeks) was carried out in four neonatal intensive care units and one CP service over a 30-month period (2012-2013). Participants were 259 high-risk infants. Sensitivity and specificity values were calculated with true positives defined as a confirmed diagnosis of CP from a medical doctor.
RESULTS: Of the 259 infants assessed, 1-year follow-up data were available for 187. Of these, n = 48 had absent fidgety (high risk for CP), n = 138 had normal fidgety (low risk for CP), and n = 1 had abnormal fidgety (high risk for a neurological disorder). Of the 48 with absent fidgety movements, 39 had received a diagnosis of CP by 18 months and another 6 had an abnormal outcome. Of the n = 138 normal fidgety cases, n = 99 cases had a normal outcome, n = 38 had an abnormal outcome but not CP, and n = 1 had CP. For detecting CP, we had a sensitivity of 98% and specificity of 94%.
CONCLUSION: GMA was feasible in an Australian context and accurately identified CP with a sensitivity and specificity comparable with European standards and published neuroimaging data.

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PMID: 26289780 [PubMed - indexed for MEDLINE]

Motricité - Mobilité – Posture

Spectroscopic biomarkers of motor cortex developmental plasticity in hemiparetic children after perinatal stroke.
Carlson HL, MacMaster FP, Harris AD, Kirton A.
Hum Brain Mapp. 2016 Nov 17. doi: 10.1002/hbm.23472. [Epub ahead of print]

Perinatal stroke causes hemiparetic cerebral palsy and lifelong motor disability. Bilateral motor cortices are key hubs within the motor network and their neurophysiology determines clinical function. Establishing biomarkers of motor cortex function is imperative for developing and evaluating restorative interventional strategies. Proton magnetic resonance spectroscopy (MRS) quantifies metabolite concentrations indicative of underlying neuronal health and metabolism in vivo. We used functional magnetic resonance imaging (MRI)-guided MRS to investigate motor cortex metabolism in children with perinatal stroke. Children aged 6-18 years with MRI-confirmed perinatal stroke and hemiparetic cerebral palsy were recruited from a population-based cohort. Metabolite concentrations were assessed using a PRESS sequence (3T, TE = 30 ms, voxel = 4 cc). Voxel location was guided by functional MRI activations during finger tapping tasks. Spectra were analysed using LCModel. Metabolites were quantified, cerebral spinal fluid corrected and compared between groups (ANCOVA) controlling for age. Associations with clinical motor performance (Assisting Hand, Melbourne, Box-and-Blocks) were assessed. Fifty-two participants were studied (19 arterial, 14 venous, 19 control). Stroke participants demonstrated differences between lesioned and nonlesioned motor cortex N-acetyl-aspartate [NAA mean concentration = 10.8 ± 1.9 vs. 12.0 ± 1.2, P < 0.01], creatine [Cre 8.0 ± 0.9 vs. 7.4 ± 0.9, P < 0.05] and myo-Inositol [Ins 6.5 ± 0.84 vs. 5.8 ± 1.1, P < 0.01]. Lesioned motor cortex NAA and creatine were strongly correlated with motor performance in children with arterial but not venous strokes. Interrogation of motor cortex by fMRI-guided MRS is feasible in children with perinatal stroke. Metabolite differences between hemispheres, stroke types and correlations with motor performance support functional relevance. MRS may be valuable in understanding the neurophysiology of developmental neuroplasticity in cerebral palsy. Hum Brain Mapp, 2016. © 2016 Wiley Periodicals, Inc.

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PMID: 27859933 [PubMed - as supplied by publisher]

Are clinical parameters sufficient to model gait patterns in patients with cerebral palsy using a multilinear approach?

Bonnefoy-Mazure A, Sagawa Y Jr, Pomero V, Lascombes P, De Coulon G, Armand S
Comput Methods Biomech Biomed Engin. 2016;19(7):800-6.doi: 10.1080/10255842.2015.1064112. Epub 2015 Aug 3.

The aim of this study was to evaluate whether clinical parameters are sufficient using, a multilinear regression model, to reproduce the sagittal plane joint angles (hip, knee, and ankle) in cerebral palsy gait. A total of 154 patients were included. The two legs were considered (308 observations). Thirty-six clinical parameters were used as regressors (range of motion, muscle strength, and spasticity of the lower). From the clinical gait analysis, the joint angles of the sagittal plane were selected. Results showed that clinical parameter does not provide sufficient information to recover joint angles and/or that the multilinear regression model is not an appropriate solution.
DOI: 10.1080/10255842.2015.1064112
PMID: 26237712 [PubMed - indexed for MEDLINE]

Are electromyographic patterns during gait related to abnormality level of the gait in patients with spastic cerebral palsy?

Syczewska M, Święcicka A
Acta Bioeng Biomech. 2016;18(3):91-96.

PURPOSE: One of the aims of the treatment in ambulant cerebral palsy (CP) patients is improvement of gait. The level of gait pathology is assessed by instrumented gait analysis, including surface electromyography. The aim of this study was to investigate the relation of the abnormality level of the gait and the co-contraction of the agonist-antagonist muscles, and relation between symmetry left /right leg in gait and symmetry of muscular activity.
METHODS: Fifty one patients with cerebral palsy underwent clinical assessment and instrumented gait analysis, including surface electromyography. Signals were bilaterally collected from rectus femoris, medial and lateral hamstrings, tibialis anterior, lateral gastrocnemius and gluteus maximus. In older children additionally signals from soleus and lateral vastus were recorded. Sixteen gait variables were selected to calculate Gillette Gait Index, separately for left and right leg. From the envelopes a series of cross-correlation coefficients were calculated.
RESULTS: Weak correlations were found between averaged agonistantagonist correlation coefficient and Gillette Gait Index. Differences between hemiparetic less-involved legs, hemiparetic spastic legs, and diplegic legs were

found for co-contraction of rectus femoris and biceps femoris and for averaged agonist-antagonist co-contraction. The differences between hemiparetic and diplegic groups were found for some muscle correlation coefficients.
CONCLUSIONS: The results obtained in this study show that the activity pattern of the leg muscles is specific to a given patient, and the dependence of the kinematics pathology on the abnormal activation pattern is not a direct one.
PMID: 27840431 [PubMed - in process]

Biomechanical and perceived differences between overground and treadmill walking in children with cerebral palsy.
Jung T, Kim Y, Kelly LE, Abel MF
Gait Posture. 2016 Mar;45:1-6. doi: 10.1016/j.gaitpost.2015.12.004. Epub 2015 Dec 29.

The treadmill is widely used as an instrument for gait training and analysis. The primary purpose of this study was to compare biomechanical variables between overground and treadmill walking in children with cerebral palsy (CP). Perceived differences between the two walking modes were also investigated by comparing self-selected walking speeds. Twenty children with CP performed both overground and treadmill walking at a matched speed for biomechanical comparison using a 3-D motion analysis system. In addition, they were asked to select comfortable and fastest walking speeds under each walking condition to compare perceiveddifferences. Significant differences in spatiotemporal variables were found including higher cadence and shorter stride length during treadmill walking at a matched speed (for all, P<.003). The comparison of joint kinematics demonstrated significant differences between overground and treadmill walking, which showed increases in peak angles of ankle dorsi-flexion, knee flexion/extension, and hip flexion (for all, P<.001), increases in ankle and hip excursions and a decrease in pelvic rotation excursion while walking on treadmill (for all, P<.002). Comparison of perceived difference revealed that children with CP chose significantly slower speeds when asked to select their comfortable and fastest walking speeds on the treadmill as compared to overground (for both, P<.001). Our results suggest that these biomechanical and perceived differences should be considered when using a treadmill for gait intervention or assessment.

DOI: 10.1016/j.gaitpost.2015.12.004
PMID: 26979874 [PubMed - indexed for MEDLINE]

Can Clinical Assessment of Locomotive Body Function Explain Gross Motor Environmental Performance in Cerebral Palsy?
Sanz Mengibar JM, Santonja-Medina F, Sanchez-de-Muniain P, Canteras-Jordana M.
J Child Neurol. 2016 Mar;31(4):474-80. doi: 10.1177/0883073815599264. Epub 2015 Aug 19.

Gross Motor Function Classification System has discriminative purposes but does not assess short-term therapy goals. Locomotion Stages (LS) classify postural body functions and independent activity components. Assessing the relation between Gross Motor Function Classification System level and Locomotion Stages will make us understand if clinical assessment can explain and predict motor environmental performance in cerebral palsy. A total of 462 children were assessed with both scales. High reliability and strong negative correlation (-0.908) for Gross Motor Function Classification System and Locomotion Stages at any age was found. Sensitivity was 83%, and specificity and positive predictive value were 100% within the same age range. Regression analysis showed detailed probabilities for the realization of the Gross Motor Function Classification System depending on the Locomotion Stages and the age group. Postural body function measure with Locomotion Stages is reliable, sensitive, and specific for gross motor function and able to predict environmental performance.

DOI: 10.1177/0883073815599264
PMID: 26294341 [PubMed - indexed for MEDLINE]

Coordination between pelvis and shoulder girdle during walking in bilateral cerebral palsy.
Tavernese E, Paoloni M, Mangone M, Castelli E, Santilli V
Clin Biomech (Bristol, Avon). 2016 Feb;32:142-9. doi: 10.1016/j.clinbiomech.2015.11.020. Epub 2015 Dec 8.

BACKGROUND: Studies revealed that pelvis and shoulder girdle kinematics is impaired in children with the diplegic form of bilateral cerebral palsy while walking. The features of 3D coordination between these segments, however, have never been evaluated.
METHODS: The gait analyses of 27 children with bilateral cerebral palsy (18 males; mean age 124 months) have been retrospectively reviewed from the database of a Movement Analysis Laboratory. The spatial-temporal parameters and the range-of-motions of the pelvis and of the shoulder girdle on the three planes of motion have been calculated. Continuous relative phase has been calculated for the 3D pelvis-shoulder girdle couplings on the transverse, sagittal and frontal planes of motion to determine coordination between these segments. Data from 10 typically developed children have been used for comparison.
FINDINGS: Children with bilateral cerebral palsy walk with lower velocity (P=0.01), shorter steps (P<0.0001), larger base of support (P<0.01) and increased duration of the double support phase (P=0.005) when compared to typically developed children. The mean continuous relative phase on the transverse plane has been found lower in the cerebral palsy group throughout the gait cycle (P=0.003), as well as in terminal stance, pre-swing and mid-swing. The age, gait speed and pelvis range-of-motions on the transverse plane have been found correlated to continuous relative phase on the transverse plane.
INTERPRETATION: Compared with typically developed children, children with bilateral cerebral palsy show a more in-phase coordination between the pelvis and the shoulder girdle on the transverse plane while walking.

DOI: 10.1016/j.clinbiomech.2015.11.020
PMID: 26690753 [PubMed - indexed for MEDLINE]

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.
DOI: 10.1097/BPB.0000000000000416
PMID: 27902635 [PubMed - supplied as by publisher]

Description of Primary and Secondary Impairments in Young Children With Cerebral Palsy.
Jeffries L, Fiss A, McCoy SW, Bartlett DJ.
Pediatr Phys Ther. 2016 Spring;28(1):7-14. doi: 10.1097/PEP.0000000000000221.vComment in Pediatr Phys Ther. 2016 Spring;28(1):15.

PURPOSE: We describe primary and secondary impairments in young children with cerebral palsy (CP); report differences in impairments on the basis of Gross Motor Function Classification System (GMFCS), age, and sex; and examine the extent that individual impairments account for the construct of primary and secondary impairments.
METHODS: Participants included 429 children with CP (242 [56%] male; 1½ to 5 years) representing all GMFCS levels. Reliable assessors collected primary and secondary impairment data using clinical measures. Analyses included descriptive statistics, comparisons among GMFCS, age, and sex, and factor analysis.
RESULTS: Young children with CP present with primary and secondary impairments. Significant differences in impairments occur among some GMFCS levels and age groups but not sex groups. Postural stability contributed most to primary impairments and strength to secondary impairments.
CONCLUSION: Young children with CP across GMFCS levels may have already developed secondary impairments that should be addressed within therapy services.
DOI: 10.1097/PEP.0000000000000221
PMID: 27088676 [PubMed - indexed for MEDLINE]

Dissipation of disturbances seen in the knee joint kinematics of children with cerebral palsy.
Kurz MJ, Arpin DJ, Davies BL, Gehringer JE
Acta Bioeng Biomech. 2015;17(4):67-72.

PURPOSE: Children with cerebral palsy (CP) often use a crouch gait pattern that has disturbances in the knee joint kinematics. Although the length and rate of lengthening of the hamstring musculature have been speculated to be the reason that these disturbances are not adequately dissipated, this relationship has not been adequately explored. The purpose of this exploratory investigation was to use simulations of a musculoskeletal model and Floquet analysis to evaluate how the performance of hamstrings musculature during gait may be related to the knee joint instabilities seen in children with CP.
METHODS: Children with CP and typically developing (TD) children walked on a treadmill as a motion capture system assessed the knee joint kinematics. Floquet analysis was used to quantify the rate that disturbances present at the knee joint were dissipated, and simulations of a musculoskeletal model were used to estimate the in vivo length and velocity of the hamstrings. Pearson correlation coefficients were calculated to determine if there was a relationship between the rate that the disturbances were dissipated and the performance of the hamstring musculature.
RESULTS: The children with CP had hamstrings that lengthened more slowly than TD children, and required more strides to dissipate disturbances in the knee joint kinematics. There was negative correlation between the rate that the hamstrings lengthened and the rate that the knee joint disturbances were dissipated.
CONCLUSIONS: Our results suggest that the ability of children with CP to dissipate the knee joint disturbances may be related to the inability to properly control the hamstring musculature.
PMID: 26900106 [PubMed - indexed for MEDLINE]

Immature Spinal Locomotor Output in Children with Cerebral Palsy.
Cappellini G, Ivanenko YP, Martino G, MacLellan MJ, Sacco A, Morelli D, Lacquaniti F
Front Physiol. 2016 Oct 25;7:478. eCollection 2016.

Detailed descriptions of gait impairments have been reported in cerebral palsy (CP), but it is still unclear how maturation of the spinal motoneuron output is affected. Spatiotemporal alpha-motoneuron activation during walking can be assessed by mapping the electromyographic activity profiles from several, simultaneously recorded muscles onto the anatomical rostrocaudal location of the motoneuron pools in the spinal cord, and by means of factor analysis of the muscle activity profiles. Here, we analyzed gait kinematics and EMG activity of 11 pairs of bilateral muscles with lumbosacral innervation in 35 children with CP (19 diplegic, 16 hemiplegic, 2-12 years) and 33 typically developing (TD) children (1-12 years). TD children showed a progressive reduction of EMG burst durations and a gradual reorganization of the spatiotemporal motoneuron output with increasing age. By contrast, children with CP showed very limited age-related changes of EMG durations and motoneuron output, as well as of limb intersegmental coordination and foot trajectory control (on both sides for diplegic children and the affected side for hemiplegic children). Factorization of the EMG signals revealed a comparable structure of the motor output in children with CP and TD children, but significantly wider temporal activation patterns in children with CP, resembling the patterns of much younger TD infants. A similar picture emerged when considering the spatiotemporal maps of alpha-motoneuron activation. Overall, the results are consistent with the idea that early injuries to developing motor regions of the brain substantially affect the maturation of the spinal locomotor output and consequently the future locomotor behavior.
Free PMC Article
DOI: 10.3389/fphys.2016.00478
PMCID: PMC5078720
PMID: 27826251 [PubMed - in process]

Influence of patellar position on the knee extensor mechanism in normal and crouched walking.
Lenhart RL, Brandon SC, Smith CR, Novacheck TF, Schwartz MH, Thelen DG
J Biomech. 2016 Nov 22. pii: S0021-9290(16)31231-3. doi: 10.1016/j.jbiomech.2016.11.052

Patella alta is common in cerebral palsy, especially in patients with crouch gait. Correction of patella alta has been advocated in the treatment of crouch, however the appropriate degree of correction and the implications for knee extensor function remain unclear. Therefore, the goal of this study was to assess the impact of patellar position on

quadriceps and patellar tendon forces during normal and crouch gait. To this end, a lower extremity musculoskeletal model with a novel 12 degree of freedom knee joint was used to simulate normal gait in a healthy child, as well as mild (23 deg min knee flexion in stance), moderate (41 deg), and severe (67 deg) crouch gait in three children with cerebral palsy. The simulations revealed that quadriceps and patellar tendon forces increase dramatically with crouch, and are modulated by patellar position. For example with a normal patellar tendon position, peak patellar tendon forces were 0.7 times body weight in normal walking, but reached 2.2, 3.2 and 5.4 times body weight in mild, moderate and severe crouch. Moderate patella alta acted to reduce quadriceps and patellar tendon loads in crouch gait, due to an enhancement of the patellar tendon moment arms with alta in a flexed knee. In contrast, patella baja reduced the patellar tendon moment arm in a flexed knee and thus induced an increase in the patellar tendon loads needed to walk in crouch. Functionally, these results suggest that patella baja could also compromise knee extensor function for other flexed knee activities such as chair rise and stair climbing. The findings are important to consider when using surgical approaches for correcting patella alta in children who exhibit crouch gait patterns.

DOI: 10.1016/j.jbiomech.2016.11.052
PMID: 27939752 [PubMed - as supplied by publisher]

Kinematic characteristics of reaching in children with hemiplegic cerebral palsy: A comparative study.
Aboelnasr EA, Hegazy FA, Altalway HA
Brain Inj. 2016 Nov 10:1-7. [Epub ahead of print]

BACKGROUND: Practitioners need more sensitive measures to quantify reaching movement for judgement of the treatment effects and reflecting the degrees of motor impairment in upper extremities.
OBJECTIVE: The purposes of this study were to differentiate between spastic and normal reaching using three-dimensional (3D) motion analysis and to quantify the interference of spasticity on reaching movement in children with congenital hemiplegic cerebral palsy.
METHODS: Fifteen children with hemiplegic CP as a study group and 15 normal typically-developing (TD) children as a control group were studied. Participants were asked to reach forward, at a self-selected pace, toward one target at a normalized distance. A motion analysis system was used to record the trajectory of reaching performance. Kinematic parameters were computed and analysed.
RESULTS: There were significant differences between the normal and spastic reaching ($p < 0.001$). Hemiplegic CP demonstrated slower and less smooth (higher normalized jerk score and more movement units) movement than the TD group, this reflects feedback guidance to correct spatial inaccuracy of reaching in hemiplegic CP.
CONCLUSION: Kinematic analysis quantifies reaching characteristics and provides objective information about the motor strategies associated with goal-oriented tasks.
DOI: 10.1080/02699052.2016.1210230
PMID: 27830945 [PubMed - as supplied by publisher]

Kinematic parameters of hand movement during a disparate bimanual movement task in children with unilateral Cerebral Palsy.
Rudisch J, Butler J, Izadi H, Zielinski IM, Aarts P, Birtles D, Green D
Hum Mov Sci. 2016 Apr;46:239-50. doi: 10.1016/j.humov.2016.01.010.

Children with unilateral Cerebral Palsy (uCP) experience problems performing tasks requiring the coordinated use of both hands (bimanual coordination; BC). Additionally, some children with uCP display involuntary symmetrical activation of the opposing hand (mirrored movements). Measures, used to investigate therapy-related improvements focus on the functionality of the affected hand during unimanual or bimanual tasks. None however specifically address spatiotemporal integration of both hands. We explored the kinematics of hand movements during a bimanual task to identify parameters of BC. Thirty-seven children (aged 10.9±2.6years, 20 male) diagnosed with uCP participated. 3D kinematic motion analysis was performed during the task requiring opening of a box with their affected- (AH) or less-affected hand (LAH), and pressing a button inside with the opposite hand. Temporal and spatial components of data were extracted and related to measures of hand function and level of impairment. Total task duration was correlated with the Jebsen-Taylor Test of Hand Function in both conditions (either hand leading with the lid-opening). Spatial accuracy of the LAH when the box was opened with their AH was correlated with outcomes on the Children's Hand Use Experience Questionnaire. Additionally, we found a subgroup of children

displaying non-symmetrical movement interference associated with greater movement overlap when their affected hand opened the box. This subgroup also demonstrated decreased use of the affected hand during bimanual tasks. Further investigation of bimanual interference, which goes beyond small scaled symmetrical mirrored movements, is needed to consider its impact on bimanual task performance following early unilateral brain injury.

DOI: 10.1016/j.humov.2016.01.010
PMID: 26803675 [PubMed - indexed for MEDLINE]

Lower Extremity Handheld Dynamometry Strength Measurement in Children With Cerebral Palsy.
Mulder-Brouwer AN, Rameckers EA, Bastiaenen CH.
Pediatr Phys Ther. 2016 Summer;28(2):136-53. doi: 10.1097/PEP.0000000000000228.

PURPOSE: The purpose of this study was to evaluate the evidence on reliability of handheld dynamometry protocols to quantify maximal isometric strength of the muscles of the lower extremities of children with cerebral palsy.
METHODS: A systematic search of Cochrane, MEDLINE, CINAHL, and PubMed up to December 2013 and best-evidence synthesis were performed.
RESULTS: Seven eligible studies were identified. Best-evidence synthesis revealed "unknown" to "moderate" evidence. Intraclass correlation coefficient values were "positive" for most muscle groups for intrarater reliability and showed mixed results for interrater reliability.
CONCLUSIONS: Because of small sample sizes (10-25) in all included studies, the final level of evidence remains "unknown." Reliability data obtained in the included studies of handheld dynamometry in children with cerebral palsy are promising, despite low levels of evidence. When these protocols are applied very carefully, they may prove relevant to different clinical settings.
DOI: 10.1097/PEP.0000000000000228
PMID: 26744991 [PubMed - indexed for MEDLINE]

Medial gastrocnemius specific force of adult men with spastic cerebral palsy.
Hussain AW, Onambele GL, Williams AG, Morse CI
Muscle Nerve. 2016 Nov 15. doi: 10.1002/mus.25477. [Epub ahead of print]

INTRODUCTION: Muscle weakness determines functional impairment in spastic cerebral palsy (SCP). Measurement of specific force (SF) allows for strength comparison with unimpaired populations (controls) accounting for neural (activation and coactivation), architectural (fascicle length and pennation angle), and structural differences (moment arm length).
METHODS: Medial gastrocnemius (MG) SF (and its determinants) was assessed in both paretic and non-paretic legs of 11 men with SCP and 11 age-matched controls during plantarflexion maximal voluntary isometric contraction (MVIC).
RESULTS: SCP fascicles were 28% longer than controls ($P<0.05$). Pennation angle of SCP was 41% smaller than controls. The PCSA of SCP MG was 47% smaller than controls ($P<0.05$). There was no difference in SF between controls and SCP.

DOI: 10.1002/mus.25477
PMID: 27862024 [PubMed - as supplied by publisher]

Pathological and physiological muscle co-activation during active elbow extension in children with unilateral cerebral palsy.
Sarcher A, Raison M, Leboeuf F, Perrouin-Verbe B, Brochard S, Gross R
Clin Neurophysiol. 2016 Oct 29;128(1):4-13. doi: 10.1016/j.clinph.2016.10.086.

OBJECTIVE: To address the roles and mechanisms of co-activation in two flexor/extensor pairs during elbow extension in children with cerebral palsy (CP).
METHODS: 13 Typically Developing (TD) and 13 children with unilateral spastic CP performed elbow extension/flexion at different speeds. Elbow angle and velocity were recorded using a 3D motion analysis system.

The acceleration and deceleration phases of extension were analyzed. Co-activation of the brachioradialis/triceps and biceps/triceps pairs was computed for each phase from surface electromyographic signals. Statistical analysis involved linear mixed effects models and Spearman rank correlations.
RESULTS: During the acceleration phase, there was strong co-activation in both muscle pairs in the children with CP, which increased with speed. Co-activation was weak in the TD children and it was not speed-dependent. During the deceleration phase, co-activation was strong and increased with speed in both groups; co-activation of brachioradialis/triceps was stronger in children with CP, and was negatively correlated with extension range and positively correlated with flexor spasticity.
CONCLUSIONS: Abnormal patterns of co-activation in children with CP were found throughout the entire movement. Co-activation was specific to the movement phase and to each flexor muscle.
SIGNIFICANCE: Co-activation in children with CP is both physiological and pathological.

DOI: 10.1016/j.clinph.2016.10.086
PMID: 27866118 [PubMed - as supplied by publisher]

Real-time feedback to improve gait in children with cerebral palsy.
van Gelder L, Booth AT, van de Port I, Buizer AI, Harlaar J, van der Krogt MM.
Gait Posture. 2016 Nov 11;52:76-82. doi: 10.1016/j.gaitpost.2016.11.021.

Real-time feedback may be useful for enhancing information gained from clinical gait analysis of children with cerebral palsy (CP). It may also be effective in functional gait training, however, it is not known if children with CP can adapt gait in response to real-time feedback of kinematic parameters. Sixteen children with cerebral palsy (age 6-16; GMFCS I-III), walking with a flexed-knee gait pattern, walked on an instrumented treadmill with virtual reality in three conditions: regular walking without feedback (NF), feedback on hip angle (FH) and feedback on knee angle (FK). Clinically relevant gait parameters were calculated and the gait profile score (GPS) was used as a measure of overall gait changes between conditions. All children, except one, were able to improve hip and/or knee extension during gait in response to feedback, with nine achieving a clinically relevant improvement. Peak hip extension improved significantly by 5.1±5.9° (NF: 8.9±12.8°, FH: 3.8±10.4°, p=0.01). Peak knee extension improved significantly by 7.7±7.1° (NF: 22.2±12.0°, FK: 14.5±12.7°, p<0.01). GPS did not change between conditions due to increased deviations in other gait parameters. Responders to feedback were shown to have worse initial gait as measured by GPS (p=0.005) and functional selectivity score (p=0.049). In conclusion, ambulatory children with CP show adaptability in gait and are able to respond to real-time feedback, resulting in significant and clinically relevant improvements in peak hip and knee extension. These findings show the potential of real-time feedback as a tool for functional gait training and advanced gait analysis in CP.

DOI: 10.1016/j.gaitpost.2016.11.021
PMID: 27883988 [PubMed - as supplied by publisher]

Repeatability of muscle synergies within and between days for typically developing children and children with cerebral palsy.
Gait Posture. 2016 Mar;45:127-32. doi: 10.1016/j.gaitpost.2016.01.011. Epub 2016 Jan 28.
Shuman B, Goudriaan M, Bar-On L, Schwartz MH, Desloovere K, Steele KM

Muscle synergies are typically calculated from electromyographic (EMG) signals using nonnegative matrix factorization. Synergies identify weighted groups of muscles that are commonly activated together during a task, such as walking. Synergy analysis has become an emerging tool to evaluate neuromuscular control; however, the repeatability of synergies between trials and days has not been evaluated. The goal of this study was to evaluate the repeatability of synergy complexity and structure in unimpaired individuals and individuals with cerebral palsy (CP). EMG data were collected from eight lower-limb muscles during gait for six typically developing (TD) children and five children with CP on two separate days, over three walking speeds. To evaluate synergy complexity, we calculated the total variance accounted for by one synergy (tVAF1). On a given day, the average range in tVAF1 between gait cycles was 18.2% for TD and 19.1% for CP. The average standard deviation in tVAF1 between gait cycles was 4.9% for TD and 5.0% for CP. Average tVAF1 calculated across gait cycles was not significantly different between days for TD

or CP participants. Comparing synergy structure, the average (standard deviation) within day correlation coefficients of synergy weights for two or more synergies were 0.89 (0.15) for TD and 0.88 (0.15) for CP. Between days, the average correlation coefficient of synergy weights for two or more synergies was greater than 0.89 for TD and 0.74 for CP. These results demonstrate that synergy complexity and structure averaged over multiple gait cycles are repeatable between days in both TD and CP groups.

DOI: 10.1016/j.gaitpost.2016.01.011
PMID: 26979894 [PubMed - indexed for MEDLINE]

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.

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.

DOI: 10.1016/j.gaitpost.2016.11.031
PMID: 27889619 [PubMed - as supplied by publisher]

Specific characteristics of abnormal general movements are associated with functional outcome at school age.
Hamer EG, Bos AF, Hadders-Algra M
Early Hum Dev. 2016 Apr;95:9-13. doi: 10.1016/j.earlhumdev.2016.01.019. Epub 2016 Feb 18.

BACKGROUND: Assessing the quality of general movements (GMs) is a non-invasive tool to identify at early age infants at risk for developmental disorders.
AIM: To investigate whether specific characteristics of definitely abnormal GMs are associated with developmental outcome at school age.
STUDY DESIGN: Observational cohort study (long-term follow-up).
SUBJECTS: Parents of 40 children (median age 8.3 years, 20 girls) participated in this follow-up study. In infancy (median corrected age 10 weeks), the children (median gestational age 30.3 weeks; birth weight 1243 g) had shown definitely abnormal GMs according to Hadders-Algra (2004). Information on specific GM characteristics such as the presence of fidgety movements, degree of complexity and variation, and stiff movements, was available (see Hamer et al. 2011).
OUTCOME MEASURES: A standardised parental interview (presence of CP, attendance of school for special education, Vineland Adaptive Behavior Scale to determine functional performance) and questionnaires (Developmental Coordination Disorder Questionnaire [DCD-Q] to evaluate mobility and Child Behavior Checklist to assess behaviour) were used as outcome measures.
RESULTS: Six children had cerebral palsy (CP), ten children attended a school for special education, and eight children had behavioural problems. Both the absence of fidgety movements and the presence of stiff movements were associated with CP ($p=0.001$; $p=0.003$, respectively). Stiff movements were also related to the need of special education ($p=0.009$). A lack of movement complexity and variation was associated with behavioural problems ($p=0.007$). None of the GM characteristics were related to DCD-Q scores.
CONCLUSIONS: The evaluation of fidgety movements and movement stiffness may increase the predictive power of definitely abnormal GMs for motor outcome—in particular CP. This study endorses the notion that the quality of GMs reflects the integrity of the infant's brain, assisting prediction of long-term outcome.

DOI: 10.1016/j.earlhumdev.2016.01.019
PMID: 26896696 [PubMed - indexed for MEDLINE]

The role of altered proximal femoral geometry in impaired pelvis stability and hip control during CP gait: A simulation study.

Bosmans L, Jansen K, Wesseling M, Molenaers G, Scheys L, Jonkers I.

Gait Posture. 2016 Feb;44:61-7. doi: 10.1016/j.gaitpost.2015.11.010. Epub 2015 Nov 30.

Children with cerebral palsy (CP) often present aberrant hip geometry, more specifically increased femoral anteversion and neck-shaft angle. Furthermore, altered gait patterns are present within this population. This study analyzed the effect of aberrant femoral geometry, as present in subjects with CP, on the ability of muscles to control hip and knee joint kinematics. Given the specific gait deficits observed during crouch gait, increased ability to abduct, externally rotate the hip and extend the knee and hip were denoted as beneficial effects. We ran dynamic simulations of CP and normal gait using two musculoskeletal models, one reflecting normal femoral geometry and one reflecting proximal femoral deformities. The results show that the combination of aberrant bone geometry and CP-specific gait characteristics beneficially increased the ability of gluteus medius and maximus to extend the hip and knee. In contrast, the potentials of the hamstrings to extend the hip decreased whereas the potentials to flex the knee increased. These changes closely followed the observed changes in the muscle moment arm lengths. In conclusion, this study emphasizes the concomitant effect of the presence of proximal femoral deformity and CP gait characteristics on the muscle control of hip and knee joint kinematics during single stance. Not accounting for subject-specific geometry will affect the calculated muscles' potential during gait. Therefore, the use of generic models to assess muscle function in the presence of femoral deformity and CP gait should be treated with caution.

DOI: 10.1016/j.gaitpost.2015.11.010
PMID: 27004634 [PubMed - indexed for MEDLINE]

The Salford Gait Tool: Does the clinical experience of the raters influence the inter-rater reliability?

Paci M, Mini G, Marchettini M, Ferrarello F.

Dev Neurorehabil. 2016 Nov 7:1-2. [Epub ahead of print]

PURPOSE: The purpose of this study was to verify if the amount of experience or the specific professional field of the raters may influence inter-rater reliability of the Salford Gait Tool (SF-GT).
METHODS: Standardized videos of gait of seven children with cerebral palsy were recorded and assessed by three physiotherapists with experience in pediatrics (PPTs), three physiotherapists with experience with adult individuals (n-PPTs), and three students of physiotherapy.
RESULTS: The inter-rater reliability both for joints and gait events was acceptable (ICC ≥ .70) for PPTs and n-PPTs, but not for students.
CONCLUSIONS: The inter-rater reliability of the SF-GT can be influenced by the experience of the raters and the amount of clinical experience seems to be more relevant than the specific professional field. Further research should be conducted with larger samples.
DOI: 10.1080/17518423.2016.1247922
PMID: 27820658 [PubMed - as supplied by publisher]

The use of turning tasks in clinical gait analysis for children with cerebral palsy.

Dixon PC, Stebbins J, Theologis T, Zavatsky AB.

Clin Biomech (Bristol, Avon). 2016 Feb;32:286-94. doi: 10.1016/j.clinbiomech.2015.10.010. Epub 2015 Nov 6.

BACKGROUND: Turning while walking is a crucial component of locomotion that is performed using an outside (step) or inside (spin) limb strategy. The aims of this paper were to determine how children with cerebral palsy perform turning maneuvers and if specific kinematic and kinetic adaptations occur compared to their typically developing peers.
METHODS: Motion capture data from twenty-two children with cerebral palsy and fifty-four typically developing children were collected during straight and 90° turning gait trials. Experimental data were used to compute spatio-temporal parameters, margin of stability, ground reaction force impulse, as well as joint kinematics and kinetics.

FINDINGS: Both child groups preferred turning using the spin strategy. The group of children with cerebral palsy exhibited the following adaptations during turning gait compared to the typically developing group: stride length was decreased across all phases of the turn with largest effect size for the depart phase (2.02), stride width was reduced during the turn phase, but with a smaller effect size (0.71), and the average margin of stability during the approach phase of turning was reduced (effect size of 0.98). Few overall group differences were found for joint kinematic and kinetic measures; however, in many cases, the intra-subject differences between straight walking and turning gait were larger for the majority of children with cerebral palsy than for the typically developing children.
INTERPRETATION: In children with cerebral palsy, turning gait may be a better discriminant of pathology than straight walking and could be used to improve the management of gait abnormalities.

DOI: 10.1016/j.clinbiomech.2015.10.010
PMID: 26549659 [PubMed - indexed for MEDLINE]

Thorax and pelvis kinematics during walking, a comparison between children with and without cerebral palsy: A systematic review.

Swinnen E, Goten LV, De Koster B, Degelaen M.
NeuroRehabilitation. 2016;38(2):129-46. doi: 10.3233/NRE-161303.

BACKGROUND: Dysfunctional postural control and pathological thorax and pelvis motions are often observed in children with cerebral palsy (CP) and can be considered as an indicator of diminished dynamic stability.
OBJECTIVE: The aim of this study was to identify the differences between children with CP and typically developing children in three-dimensional thorax and pelvis kinematics during walking.
METHODS: Three electronic databases were searched by using different combinations of keywords. The methodological quality of the studies was assessed by two researchers with the Strobe quality checklist.
RESULTS: Ten studies (methodological quality: 32% to 74%) with in total 259 children with CP and 220 typically developing children (mean age: 7.6 to 13.6 year) were included. Compared to typically developing children, children with bilateral CP showed an increased range of motion of the thorax, pelvis and spine during walking. The results of the children with unilateral CP were less clear.
CONCLUSION: In general, children with bilateral CP showed larger movement amplitudes of the trunk compared to children without CP. This increase in movement amplitudes could influence the dynamic stability of the body during walking. In children with unilateral CP, the results were less obvious and further research on this topic is required.
DOI: 10.3233/NRE-161303
PMID: 26923354 [PubMed - indexed for MEDLINE]

Toward modeling locomotion using electromyography-informed 3D models: application to cerebral palsy.

Sartori M, Fernandez JW, Modenese L, Carty CP, Barber LA, Oberhofer K, Zhang J, Handsfield GG, Stott NS, Besier TF, Farina D, Lloyd DG
Wiley Interdiscip Rev Syst Biol Med. 2016 Dec 21. doi: 10.1002/wsbm.1368. [Epub ahead of print]

This position paper proposes a modeling pipeline to develop clinically relevant neuromusculoskeletal models to understand and treat complex neurological disorders. Although applicable to a variety of neurological conditions, we provide direct pipeline applicative examples in the context of cerebral palsy (CP). This paper highlights technologies in: (1) patient-specific segmental rigid body models developed from magnetic resonance imaging for use in inverse kinematics and inverse dynamics pipelines; (2) efficient population-based approaches to derive skeletal models and muscle origins/insertions that are useful for population statistics and consistent creation of continuum models; (3) continuum muscle descriptions to account for complex muscle architecture including spatially varying material properties with muscle wrapping; (4) muscle and tendon properties specific to CP; and (5) neural-based electromyography-informed methods for muscle force prediction. This represents a novel modeling pipeline that couples for the first time electromyography extracted features of disrupted neuromuscular behavior with advanced numerical methods for modeling CP-specific musculoskeletal morphology and function. The translation of such pipeline to the clinical level will provide a new class of biomarkers that objectively describe the neuromusculoskeletal determinants of pathological locomotion and complement current clinical assessment techniques, which often rely on subjective judgment. For further resources related to this article, please visit the WIREs website.

DOI: 10.1002/wsbm.1368
PMID: 28002649 [PubMed - as supplied by publisher]

Using a goal attainment scale in the evaluation of outcomes in patients with diplegic cerebral palsy.
McMorran D, Robinson LW, Henderson G, Herman J, Robb JE, Gaston MS.
Gait Posture. 2016 Feb;44:168-71. doi: 10.1016/j.gaitpost.2015.12.003. Epub 2015 Dec 14.

A goal attainment scale (GAS) was used to evaluate outcomes of surgical and non-surgical interventions to improve gait in 45 children with diplegic cerebral palsy. Personal goals were recorded during pre-intervention gait analysis in two groups. Twenty children underwent orthopaedic surgery (Group 1) and 25 children received a non-operative intervention (Group 2). Children and/or their carers were contacted post-intervention by telephone to complete a GAS questionnaire, rating the achievement of goals on a 5-point scale. The goals were similar in both groups. The composite GAS was transformed into a standardised measure (T-score) for each patient. Both groups on average achieved their goals (mean T-score for Group 2 was 56.3, versus 47.1 for Group 1). The difference between these two means was significant (p=0.010). Additionally, 16 children had undergone a follow-up gait analysis during the study period, but the relationship between their Gait Profile Score and GAS was not statistically significant. Both surgical and non-surgical interventions enabled children to achieve their goals, although Group 1 reported higher achievements. The GAS reflects patient's/parent's/carer's aspirations and may be as relevant as post-intervention kinematic or kinetic outcomes.

DOI: 10.1016/j.gaitpost.2015.12.003
PMID: 27004652 [PubMed - indexed for MEDLINE]

Cognition

Event-related Potentials During Target-response Tasks to Study Cognitive Processes of Upper Limb Use in Children with Unilateral Cerebral Palsy.
Zielinski IM, Steenbergen B, Baas CM, Aarts P, Jongsma ML.
J Vis Exp. 2016 Jan 11;(107). doi: 10.3791/53420.

Unilateral Cerebral Palsy (CP) is a neurodevelopmental disorder that is a very common cause of disability in hildhood. It is characterized by unilateral motor impairments that are frequently dominated in the upper limb. In addition to a reduced movement capacity of the affected upper limb, several children with unilateral CP show a reduced awareness of the remaining movement capacity of that limb. This phenomenon of disregarding the preserved capacity of the affected upper limb is regularly referred to as Developmental Disregard (DD). Different theories have been postulated to explain DD, each suggesting slightly different guidelines for therapy. Still, cognitive processes that might additionally contribute to DD in children with unilateral CP have never been directly studied. The current protocol was developed to study cognitive aspects involved in upper limb control in children with unilateral CP with and without DD. This was done by recording event-related potentials (ERPs) extracted from the ongoing EEG during target-response tasks asking for a hand-movement response. ERPs consist of several components, each of them associated with a well-defined cognitive process (e.g., the N1 with early attention processes, the N2 with cognitive control and the P3 with cognitive load and mental effort). Due to its excellent temporal resolution, the ERP technique enables to study several covert cognitive processes preceding overt motor responses and thus allows insight into the cognitive processes that might contribute to the phenomenon of DD. Using this protocol adds a new level of explanation to existing behavioral studies and opens new avenues to the broader implementation of research on cognitive aspects of developmental movement restrictions in children.
DOI: 10.3791/53420
PMCID: PMC4781417
PMID: 26780483 [PubMed - indexed for MEDLINE]

Traitement - Rééducation motrice et cognitive

Comparative Effectiveness Research and Children With Cerebral Palsy: Identifying a Conceptual Framework and Specifying Measures.
Gannotti ME, Law M, Bailes AF, O'Neil ME, Williams U, DiRezze B; Expert Panel. Collaborators: Andrade C, Bagley A, Bellows D, Chapman S, Crooks L, Gorton G 3rd, Hurley D, Leiter M, Malczynski M, Mulcahey MJ, Reder R, Scalzitti D, Schreiber J, Shah D, Watson D.
Pediatr Phys Ther. 2016 Spring;28(1):58-69. doi: 10.1097/PEP.0000000000000203.
Comment in Pediatr Phys Ther. 2016 Spring;28(1):70.

PURPOSE: A step toward advancing research about rehabilitation service associated with positive outcomes for children with cerebral palsy is consensus about a conceptual framework and measures.
METHODS: A Delphi process was used to establish consensus among clinicians and researchers in North America.
RESULTS: Directors of large pediatric rehabilitation centers, clinicians from large hospitals, and researchers with expertise in outcomes participated (N = 18). Andersen's model of health care utilization framed outcomes: consumer satisfaction, activity, participation, quality of life, and pain. Measures agreed upon included Participation and Environment Measure for Children and Youth, Measure of Processes of Care, PEDI-CAT, KIDSCREEN-10, PROMIS Pediatric Pain Interference Scale, Visual Analog Scale for pain intensity, PROMIS Global Health Short Form, Family Environment Scale, Family Support Scale, and functional classification levels for gross motor, manual ability, and communication.
CONCLUSIONS: Universal forms for documenting service use are needed. Findings inform clinicians and researchers concerned with outcome assessment.
DOI: 10.1097/PEP.0000000000000203
PMID: 27088688 [PubMed - indexed for MEDLINE]

Effect of early intervention in infants at very high risk of cerebral palsy: a systematic review.
Hadders-Algra M(1), Boxum AG(1), Hielkema T(1,)(2), Hamer EG(1,)(3).
Dev Med Child Neurol. 2016 Dec 7. doi: 10.1111/dmcn.13331. [Epub ahead of print]

AIM: First, to systematically review the evidence on the effect of intervention applied during the first postnatal year in infants with or at very high risk of cerebral palsy (CP) on child and family outcome. Second, to assess whether type and dosing of intervention modify the effect of intervention.
METHOD: Relevant literature was identified by searching the PubMed, Embase, and CINAHL databases. Selection criteria included infants younger than 12 months corrected age with or at very high risk of CP. Methodological quality including risk of bias was scrutinized. RESULTS: Thirteen papers met the inclusion criteria. Seven studies with moderate to high methodological quality were analysed in detail; they evaluated neurodevelopmental treatment only (n=2), multisensory stimulation (n=1), developmental stimulation (n=2), and multifaceted interventions consisting of a mix of developmental stimulation, support of parent-infant interaction, and neurodevelopmental treatment (n=2). The heterogeneity precluded conclusions. Yet, two suggestions emerged: (1) dosing may be critical for effectiveness; (2) multifaceted intervention may offer best opportunities for child and family.
INTERPRETATION: The literature on early intervention in very high-risk infants with sufficient methodological quality is limited, heterogeneous, and provides weak evidence on the effect. More studies are urgently needed. Suggestions for future research are provided.

DOI: 10.1111/dmcn.13331
PMID: 27925172 [PubMed - as supplied by publisher]

Interpreting Intervention Induced Neuroplasticity with fMRI: The Case for Multimodal Imaging Strategies.
Reid LB, Boyd RN, Cunnington R, Rose SE
Neural Plast. 2016;2016:2643491. doi: 10.1155/2016/2643491. Epub 2015 Dec 29.

Direct measurement of recovery from brain injury is an important goal in neurorehabilitation, and requires reliable, objective, and interpretable measures of changes in brain function, referred to generally as "neuroplasticity." One popular imaging modality for measuring neuroplasticity is task-based functional magnetic resonance imaging (t-fMRI). In the field of neurorehabilitation, however, assessing neuroplasticity using t-fMRI presents a significant challenge. This commentary reviews t-fMRI changes commonly reported in patients with cerebral palsy or acquired

brain injuries, with a focus on studies of motor rehabilitation, and discusses complexities surrounding their interpretations. Specifically, we discuss the difficulties in interpreting t-fMRI changes in terms of their underlying causes, that is, differentiating whether they reflect genuine reorganisation, neurological restoration, compensation, use of preexisting redundancies, changes in strategy, or maladaptive processes. Furthermore, we discuss the impact of heterogeneous disease states and essential t-fMRI processing steps on the interpretability of activation patterns. To better understand therapy-induced neuroplastic changes, we suggest that researchers utilising t-fMRI consider concurrently acquiring information from an additional modality, to quantify, for example, haemodynamic differences or microstructural changes. We outline a variety of such supplementary measures for investigating brain reorganisation and discuss situations in which they may prove beneficial to the interpretation of t-fMRI data.

Free PMC Article

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PMCID: PMC4709757
PMID: 26839711 [PubMed - indexed for MEDLINE]

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.

BACKGROUND: 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.
METHODS: 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.
RESULTS: 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.
CONCLUSION: 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.

Free Article

DOI: 10.1186/s12887-016-0731-6
PMID: 27899082 [PubMed - in process]

What's New in the Management of Foot Deformities in Children With Cerebral Palsy.

Heydemann JA, Abousamra O, Franzone JM, Kaufman BE, Sees JP.

J Pediatr Orthop. 2016 Nov 17. [Epub ahead of print]

BACKGROUND: Foot deformities have been frequently reported in cerebral palsy (CP), and numerous diagnostic modalities and treatment options have recently been developed to achieve a better level of management for children with CP.
METHODS: A thorough search of the English literature, published between January 2013 and March 2016, was performed. A summary of the new findings that had not previously described was reported. The review included

recent advances regarding clinical and gait evaluation, orthotic management, botulinum toxin A treatment, and surgical correction.
RESULTS: The review summarized new findings reported in 46 articles and abstracts that were published between January 2013 and March 2016. Older articles were included and cited when an original description was mentioned, or when a change or development of some findings was discussed.
CONCLUSIONS: Foot deformity forms an essential part of evaluating children with CP. Dramatic advances have been achieved in gait assessment, conservative management, and surgical correction. Promising results have been reported with the goal to reach a higher level of orthopaedic care and optimize the functional potentials for children with CP.
LEVEL OF EVIDENCE: Level IV-literature review.
DOI: 10.1097/BPO.0000000000000901
PMID: 27861211 [PubMed - as supplied by publisher]

Pharmacologie Efficacite Tolérance

Botulinum Toxin Injections in Musculoskeletal Disorders.
Godoy IR, Donahue DM, Torriani M
Semin Musculoskelet Radiol. 2016 Nov;20(5):441-452. doi: 10.1055/s-0036-1594284. Epub 2016 Dec 21.

Botulinum toxin (BTX) is used for multiple clinical indications due to its ability to induce temporary chemodenervation and muscle paralysis. This property has supported its application in treating a variety of musculoskeletal conditions, especially those involving muscular hyperactivity and contractures such as cerebral palsy and dystonia. However, off-label use of BTX injection in other musculoskeletal disorders is gaining increased acceptance, such as in neurogenic thoracic outlet syndrome, epicondylitis, and shoulder pain after stroke. This review discusses the mechanism of action, best practices, and current indications of BTX injections in the musculoskeletal system. We also discuss the state of the science regarding BTX injections for musculoskeletal disorders and the available evidence supporting its use.
Thieme Medical Publishers 333 Seventh Avenue, New York, NY 10001, USA.
DOI: 10.1055/s-0036-1594284
PMID: 28002866 [PubMed - in process]

Botulinum Toxin Treatment of Spasticity in Adults and Children.
Moeini-Naghani I, Hashemi-Zonouz T, Jabbari B.
Semin Neurol. 2016 Feb;36(1):64-72. doi: 10.1055/s-0036-1571847. Epub 2016 Feb 11.

Spasticity is a frequent symptom in stroke, multiple sclerosis, cerebral or spinal trauma, and cerebral palsy that affects and disables a large number of adults and children. In this review, we discuss the pathophysiology and nonpharmacologic and pharmacologic treatments of spasticity with emphasis on the role of botulinum neurotoxins (BoNTs). The world literature is reviewed on double-blind and placebo-controlled clinical trials reporting safety and efficacy of BoNT treatment in adult spasticity and spasticity of children with cerebral palsy. The evidence for efficacy is presented from recommendations of the Assessment and Therapeutics subcommittee of the American Academy of Neurology. A technical section describes the techniques and recommended doses of BoNTs in spasticity.
Thieme Medical Publishers 333 Seventh Avenue, New York, NY 10001, USA.
DOI: 10.1055/s-0036-1571847
PMID: 26866498 [PubMed - indexed for MEDLINE]

Infection as a Complication of Intrathecal Baclofen Treatment in Children With Cerebral Palsy.
Bayhan IA, Sees JP, Nishnianidze T, Rogers KJ, Miller F.
J Pediatr Orthop. 2016 Apr-May;36(3):305-9. doi: 10.1097/BPO.0000000000000443.

BACKGROUND: Children with cerebral palsy (CP) and spasticity are often managed with intrathecal baclofen treatment (ITB). Complications of ITB include infection at the pump or catheter site and late complications as well as revisions of the pump and catheter because of events such as battery expiration or implant malfunction. The goal of

this study is to report the short-term and long-term incidence, risk factors, and treatment outcomes of ITB infections in children.
METHODS: This was a retrospective review of 294 children with CP. The number of ITB surgeries per patient, risk of infection for primary and secondary ITB-related procedures, microorganisms responsible, and associated factors, such as concurrent orthopaedic interventions, medical comorbidities, and subsequent management of ITB-related infections, were evaluated.
RESULTS: Infection occurred in 28/294 patients (9.5%) with a 4.9% rate per procedure. There were 14 acute (within 90 d of surgery) and 14 late infections. The infection risk per ITB procedure was 2.4%. Risk of late infection over 5-year mean follow-up was 0.95% per year. Pump removal with acute contralateral implantation was the most successful treatment of infections. Gross Motor Function Classification System level V and G-tube were the main risk factors for infection. A total of 133 concurrent orthopaedic procedures were performed during 277 ITB procedures with no increased risk of infection.
CONCLUSIONS: ITB in children with CP has a relatively low and manageable risk of infection. It is important to always consider infection as a complication with ITB because with prompt treatment the positive impact of ITB is still possible. It is safe to perform concurrent orthopaedic procedures with ITB procedures.
LEVELS OF EVIDENCE: Level III-therapeutic study.
DOI: 10.1097/BPO.0000000000000443
PMID: 26296219 [PubMed - indexed for MEDLINE]

Intrathecal Baclofen Therapy for the Treatment of Spasticity in Lithuania.
Kvascevicius R, Lapteva O, Kesiene J, Vaitkus A, Mikulenaite L, Raugalas R, Sipylaite J, Rocka S, Juocevicius 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.
Georg Thieme Verlag KG Stuttgart · New York.
DOI: 10.1055/s-0036-1593973
PMID: 27903018 [PubMed - as supplied by publisher]

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]

AIM: 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.
METHOD: 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.
RESULTS: 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.
INTERPRETATION: 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.

DOI: 10.1111/dmcn.13333
PMID: 27901263 [PubMed - as supplied by publisher]

Outcomes of Botulinum Toxin Type A Injection Followed by Rehabilitation in Cases of Cerebral Palsy With Upper Extremity Involvement.

Karaca B, Ünlü E, Köse G, Gönen E, Çakcı A

J Child Neurol. 2016 Mar;31(3):357-63. doi: 10.1177/0883073815596609. Epub 2015 Aug 3.

We evaluated the efficiency of botulinum toxin type A injection followed by a rehabilitation program including individual therapy, group therapy, and occupational therapy in cases of cerebral palsy with upper extremity involvement. A total of 29 injections were performed on 25 patients, and the patients were placed on rehabilitation program. At 3-month and 6-month assessments, there was a significant improvement in lateral grip strength, 9 Hole Peg test, Upper Limb Physician's Rating Scale and pediatric functional independence measure total scores. There were significant decreases in active range of motion in elbow extension, supination, and wrist extension, and Modified Ashworth Scale in elbow flexion, elbow pronation, and wrist flexion at 6-week, 3-month, and 6-month assessments. Combination of group therapy with traditional therapy methods after injection is effective in cases of cerebral palsy with upper extremity involvement.

DOI: 10.1177/0883073815596609
PMID: 26239492 [PubMed - indexed for MEDLINE]

Planovalgus foot deformity in cerebral palsy corrected by botulinum toxin injection in the peroneus longus: Clinical and radiological evaluations in young children.

Boulay C, Jacquemier M, Castanier E, Giorgi H, Authier G, Pomero V, Chabrol B, Jouve JL, Bollini G, Viehweger E

Ann Phys Rehabil Med. 2015 Dec;58(6):316-21. doi: 10.1016/j.rehab.2015.09.001. Epub 2015 Oct 23.

BACKGROUND: In children with cerebral palsy (CP), overactivity of the peroneus longus (PL) muscle is a major contributor to pes planovalgus. This retrospective study assessed whether abobotulinumtoxinA injections into a PL showing premature activity on electromyography (EMG) clinically improved foot morphology in children with CP.
METHODS: Study participants were <6 years old, had a diagnosis of CP, good functional abilities (Gross Motor Function Classification System level 1 or 2), equinovalgus (initial contact with the hallux or head of the first metatarsal) and overactive PL on EMG. The fore-, mid- and hindfoot were evaluated clinically and radiologically before and after injection of abobotulinumtoxinA (6-7 U/kg) into the PL. Radiological data were compared with reference values for children without pes planovalgus.
RESULTS: In total, 16 children (8 males; 10 hemiplegia, 6 diplegia; mean age: 3.2±1.5 years) received treatment. Mean pre-and post-treatment angles in clinical assessment of dorsiflexion of the talocrural articulation did not differ with both knees flexed (24.4±7.5 vs. 22.2±8.0 degrees; P=0.19) or extended (17.2±8.0 vs. 16.6±6.8 degrees; P=0.36). Radiographic data pre-treatment versus reference data revealed forefoot pronation (metatarsal stacking angle 2.1±8.3 vs. 8.0±2.9 degrees; P=0.002), midfoot planus (lateral talo-first metatarsal 28.5±15.0 vs. 13.0±7.5 degrees; P<0.001; talocalcaneal angle 54.6±8.6 vs. 49.0±6.9 degrees; P=0.004) and significantly decreased calcaneus dorsiflexion, without hindfoot equinus (calcaneal pitch angle 7.9±6.0 vs. 17.0±6.0 degrees; P<0.001). After treatment, the metatarsal stacking angle did not differ from reference values (P=0.15). As compared with before treatment, treatment improved mean angles for metatarsal stacking (2.1±8.3 vs. 7.1±3.9 degrees, respectively, P=0.002), lateral talo-first metatarsal and talocalcaneal (both P<0.001), with no change in the hindfoot.
CONCLUSION: PL may be an early target for abobotulinumtoxinA treatment in pes planovalgus associated with premature PL activity in children with CP.
Free Article

DOI: 10.1016/j.rehab.2015.09.001
PMID: 26608867 [PubMed - indexed for MEDLINE]

Relationship Between Botulinum Toxin, Spasticity, and Pain: a Survey of Patient Perception.

Shaikh A, Phadke CP, Ismail F, Boulias C.

Can J Neurol Sci. 2016 Mar;43(2):311-5. doi: 10.1017/cjn.2015.321. Epub 2015 Dec 22.

OBJECTIVE: To assess the prevalence of pain in adults with spasticity and to assess the association between the subjective experience of pain and spasticity.
DESIGN: Cross-sectional study.
SETTING: outpatient spasticity management clinic of a rehabilitation centre.
PATIENTS: Patients with upper motor neuron lesions and spasticity (n=131) were recruited.
METHODS: We assessed pain intensity and location, relationship between spasticity and pain perception, and perception of pain relief from botulinum toxin type-A (BoNTA) injections.
MAIN OUTCOME MEASURES: Pain perception rated on a 10-point numerical rating scale and pain quality.
RESULTS: 65% of the patients with spasticity reported presence of pain and 60% described it as an aching pain. More patients reported pain with movement (34%) compared to rest (21%). There was a statistically poor correlation between the severity of pain and spasticity (r=0.16; p>0.05). Most patients (80%) believed that their pain was related to spasticity and 62% reported that BoNTA injections decreased their pain.
CONCLUSIONS: The high incidence of pain noted within our sample suggests that physicians may have to consider pain management as part of spasticity treatment. Participants reported that their pain was related to their spasticity, and that it decreased after BoNTA treatment. Further study is needed to explore the relationships between objective measures of spasticity and pain.
DOI: 10.1017/cjn.2015.321
PMID: 26691344 [PubMed - indexed for MEDLINE]

Safety profile of incobotulinum toxin A [Xeomin(®)] in gastrocnemious muscles injections in children with cerebral palsy: Randomized double-blind clinical trial.
Carraro E, Trevisi E, Martinuzzi A.
Eur J Paediatr Neurol. 2016 Jul;20(4):532-7. doi: 10.1016/j.ejpn.2016.04.008. Epub 2016 Apr 22.

BACKGROUND: The only two preparations of botulinum toxin A for which there are published evidences of efficacy in children with cerebral palsy are onabotulinum toxin A (Botox(®)) and abobotulinum toxin A (Dyport(®)); these toxins should be considered generally safe and appropriate in the treatment for localized upper and lower limb spasticity.
AIMS: To establish the safety profile of incobotulinum toxin A (Xeomin(®)) in children with cerebral palsy and muscle spasticity.
METHODS: Randomized double-blind controlled trial that involved the recruitment of children of both sexes with spastic hemiplegia or diplegia in cerebral palsy, aged between 3 and 18 years. Children were randomized to either the study group (SG, incobotulinum toxin A) or the control group (CG, onabotulinum toxin A) both to be injected with 5units/kg on gastrocnemius (medialis and lateralis) muscles. The occurrence of adverse events at baseline, after 48 h, 10 days and 3 months was recorded by the caregivers in a checklist that listed both common and uncommon side effects.
RESULTS: 35 patients were treated (CG = 18; SG = 17); the 2 groups were well balanced regarding demographics and anthropometry characteristics. At least 1 adverse event occurred in 49% of patients within first 2 days, 46% between 2 and 10 days, and 12% between 10 and 90 days. All the reported events were minor; no serious adverse event was recorded. Fatigue was the most frequent complaint. There was no significant difference in frequency and type of events between the 2 groups.
CONCLUSION: Incobotulinum toxin A and onabotulinum toxin A share similar profile of safety in the treatment of lower limb spasticity in CP children.

DOI: 10.1016/j.ejpn.2016.04.008
PMID: 27177451 [PubMed - indexed for MEDLINE]

The effect of intrathecal baclofen treatment on activities of daily life in children and young adults with cerebral palsy and progressive neurological disorders.
Bonouvrié L, Becher J, Soudant D, Buizer A, van Ouwerkerk W, Vles G, Vermeulen RJ.
Eur J Paediatr Neurol. 2016 Jul;20(4):538-44. doi: 10.1016/j.ejpn.2016.02.013. Epub 2016 Mar 3.

INTRODUCTION: Intrathecal baclofen (ITB) treatment is applied in patients with spastic cerebral palsy (SCP), dystonic cerebral palsy (DCP) and progressive neurological disease (PND). Our aim was to investigate whether ITB treatment has a different effect on activities of daily life (ADL) in these groups.
METHOD: A retrospective and cross-sectional survey was conducted using a questionnaire to assess the qualitative effect of ITB (Likert scale) on different domains of functioning (mobility, personal care, communication, comfort) and satisfaction with the results. Groups were compared using non-parametric statistics. RESULTS: Questionnaires were completed for 68 patients (39 SCP, 13 DCP, 16 PND). Satisfaction scores were relatively high in all groups (7-8) and the positive effect on personal care and communication was similar in all groups. The PND group had the shortest follow-up and scored significantly less favourably for the effect on mobility and comfort.
DISCUSSION: This is the first study to show that ITB treatment has similar effects on personal care and communication in stable and progressive neurological disease. The decrease in mobility in the PND group is likely due to the progressive nature of the disease. The different effect on comfort between groups is mainly due to the smaller effect on startles in the PND group.

DOI: 10.1016/j.ejpn.2016.02.013
PMID: 26995704 [PubMed - indexed for MEDLINE]

Chirurgie

A Preliminary Study to Assess Whether Spinal Fusion for Scoliosis Improves Carer-assessed Quality of Life for Children With GMFCS Level IV or V Cerebral Palsy.
Sewell MD, Malagelada F, Wallace C, Gibson A, Noordeen H, Tucker S, Molloy S, Lehovsky J.
J Pediatr Orthop. 2016 Apr-May;36(3):299-304. doi: 10.1097/BPO.0000000000000447.

BACKGROUND: Scoliosis affects 50% of children with Gross Motor Function Classification System (GMFCS) level IV or V cerebral palsy (CP). In children with complex neurodisability following intervention, the WHO considers quality of life (QoL) should be assessed to aid decision-making and assess the effects. This study assesses whether scoliosis surgery improves carer-assessed QoL for children with severe CP.
METHODS: Retrospective review of 33 children (16 male:17 female) with GMFCS level IV/V CP and significant scoliosis. Fifteen underwent observational treatment during childhood, and 18 underwent surgery. Questionnaire and radiographic data were recorded over a 2-year period. The carer-completed Caregiver Priorities and Child Health Index of Life with Disabilities (CPCHILD) questionnaire was used to assess QoL.
RESULTS: In the observational group, Cobb angle and pelvic obliquity increased from 46 (40 to 60) and 8 degrees (0 to 28) to 62 (42 to 94) and 12 degrees (1 to 35). Mean CPCHILD score decreased from 50 (30 to 69) to 48 (27 to 69) ($P<0.05$). In the operative group, Cobb angle and pelvic obliquity decreased from 78 (52 to 125) and 14 degrees (1 to 35) to 44 (16 to 76) and 9 degrees (1 to 24). Mean CPCHILD score increased from 45 (20 to 60) to 58 (37 to 76) ($P<0.05$). Change in pain, and not presence of associated impairments, was the most significant factor affecting QoL changes for children in both groups. There was no difference in mobility, GMFCS level, feeding, or communication in either group before and after treatment.
CONCLUSIONS: Nonoperative treatment for children with GMFCS level IV/V CP and a significant scoliosis was associated with a small decrease in carer-assessed QoL over 2 years. Spinal fusion was associated with an increase in QoL. Change in pain was the most significant factor affecting QoL changes, and is therefore an important factor to consider when deciding upon surgery.
LEVEL OF EVIDENCE: Level III-therapeutic retrospective study.
DOI: 10.1097/BPO.0000000000000447
PMID: 25851675 [PubMed - indexed for MEDLINE]

Are S1 Screws a Useful Adjunct to Iliac Screws in Long Fusions to the Sacrum in Cerebral Palsy?
Schoenleber SJ, Asghar J, Bastrom TP, Shufflebarger HL; Harms Study Group.
Spine (Phila Pa 1976). 2016 Jan;41(2):139-45. doi: 10.1097/BRS.0000000000001242.

STUDY DESIGN: Multicenter prospective database review of patients with cerebral palsy (CP) and spinal deformity.

OBJECTIVE: To determine if the type of distal fixation is associated with improved correction of coronal deformity or pelvic obliquity (PO) at 2 years in long posterior fusions to the sacrum.
SUMMARY OF BACKGROUND DATA: Multiple techniques are utilized for distal fixation in patients with CP. Although there is emerging evidence that the augmentation of iliac screws with S1 screws may be beneficial, this remains controversial.
METHODS: A prospective, multicenter database was used to identify patients with CP who underwent long posterior fusions to the sacrum. Eighty-eight patients were included, 52 with iliac screws (I) and 36 with iliac and S1 screws (IS) for distal fixation. Preoperative, first erect, and 2-year follow-up radiographs and complications were analyzed. Statistical analysis was performed using ANOVA and repeated measures ANOVA with significance set at $P < 0.05$.
RESULTS: Scoliosis was the primary deformity in greater than 90% of patients in both groups (P=0.84). Preoperative coronal deformity was similar (I = 83°, IS = 87°, P = 0.49), but correction was better with the use of S1 screws on the first erect radiograph and at 2 years (I = 35°, IS = 22°, P = 0.001), reflecting correction of 58% and 74% for iliac and iliac-S1 screws, respectively ($P < 0.001$). Preoperative PO was similar (I = 29°, IS = 30°, P = 0.71) and was noted to improve more in the iliac-S1 group by 2 years (I = 11°, IS = 5°, P = 0.004), representing correction of 60% and 77% for the iliac and iliac-S1 groups, respectively (P = 0.018). There was no difference in the rate of major (P = 0.27) or minor (P = 0.65) complications in either group.
CONCLUSION: Bilateral S1 and iliac screws are associated with improved spinal deformity and PO correction at 2 years in the CP population. Two points of distal fixation, S1, and ilium should be considered for this population.
LEVEL OF EVIDENCE: 3.
DOI: 10.1097/BRS.0000000000001242
PMID: 26751059 [PubMed - indexed for MEDLINE]

Biomechanical Assessment of Patellar Advancement Procedures for Patella Alta.
Seidl A, Baldini T, Krughoff K, Shapiro JA, Lindeque B, Rhodes J, Carollo J.
Orthopedics. 2016 May 1;39(3):e492-7. doi: 10.3928/01477447-20160427-04. Epub 2016 May 2.

Crouch gait deformity is common in children with cerebral palsy and often is associated with patella alta. Patellar tendon advancement typically is used to correct patella alta and restore normal knee mechanics. The purpose of this study was to determine the mechanical strength of surgical constructs used for fixation during patellar advancement procedures. This study used a cadaveric model to determine which of 3 surgical techniques is biomechanically optimal for patellar tendon advancement in treating patella alta. Twenty-four human cadaveric knees (8 per group) were prepared using 1 of 3 different common surgical techniques: tibial tubercle osteotomy, patellar tendon partial resection and repair at the distal patella, and patellar tendon imbrication. The patella was loaded from 25 to 250 N at 1 Hz for 1000 cycles. A significant difference in patella displacement under cyclical loading was found between surgical techniques. Tibial tubercle osteotomy exhibited significantly less displacement under cyclical loading than distal patella excision and repair (P<.0001) or imbrication (P=.0088). Imbrication exhibited significantly less displacement than distal patella excision and repair (P=.0006). Tibial tubercle osteotomy survived longest. Based on failure criteria of 5 mm of displacement, tibial tubercle osteotomy lasted between 250 and 500 cycles. The other 2 techniques failed by 25 cycles. This study offers quantitative evidence regarding the relative mechanical strength of each construct and may influence choice of surgical technique.
[Orthopedics. 2016; 39(3):e492-e497.].

DOI: 10.3928/01477447-20160427-04
PMID: 27135457 [PubMed - indexed for MEDLINE]

Contribution of clinical gait analysis to single-event multi-level surgery in children with cerebral palsy.
Khouri N, Desailly E.
Orthop Traumatol Surg Res. 2016 Nov 15. pii: S1877-0568(16)30204-3. doi: 10.1016/j.otsr.2016.11.004. [Epub ahead of print]

Clinical gait analysis (CGA) has been proven useful in understanding the gait disturbances seen in children and adolescents with cerebral palsy. Another major benefit provided by CGA is a clinical and scientific evaluation of how orthopaedic surgical procedures modify gait. The information provided by instrumented CGA complements the clinical data, and the two must be interpreted jointly. Although there is some variability in the surgical details of

therapeutic strategies, CGA undoubtedly influences the planning of surgery. Although CGA improves surgical outcomes, these remain challenging to predict. CGA seems cost-effective. Internal hip rotation gait is used as an example to illustrate those benefits.

DOI: 10.1016/j.otsr.2016.11.004
PMID: 27988239 [PubMed - as supplied by publisher]

Correction of Pelvic Obliquity After Spinopelvic Fixation in Children With Cerebral Palsy: A Comparison Study With Minimum Two-Year Follow-up.
Abousamra O, Nishnianidze T, Rogers KJ, Bayhan IA, Yorgova P, Shah SA.
Spine Deform. 2016 May;4(3):217-224. doi: 10.1016/j.jspd.2015.11.001. Epub 2016 Apr 16.

STUDY DESIGN: Single institution cohort data were collected prospectively and reviewed retrospectively.
OBJECTIVES: This study aims to compare outcomes among three different instrumentation types: unit rod, iliac screws, and sacral alar iliac (SAI) screws in terms of pelvic obliquity correction in children with cerebral palsy (CP).
SUMMARY OF BACKGROUND DATA: The optimal choice for spinopelvic fixation in CP scoliosis with pelvic obliquity is controversial.
METHODS: Patients with minimum 2 years' follow-up were divided into three groups according to instrumentation type and matched based on preoperative pelvic obliquity and coronal major curve magnitude. Radiographic measurements included horizontal pelvic obliquity angle (PO), spinopelvic angle (SPA), coronal and sagittal Cobb angles, and T1 pelvic angle. Procedures were performed in one pediatric institution between 2004 and 2012. All measurements were performed by a single independent reviewer who was not involved in the procedures.
RESULTS: Seventy-seven patients (42 unit rod, 14 iliac screw, and 21 SAI screw) were included. Gender and age distribution was similar across all groups (56% males, 44% females, mean age 13.5 years). Mean follow-up was 3.6 years. Comparing pre- and postoperative measurements, there was a significant decrease ($p < .05$) in PO, SPA, and coronal major cob angle in all groups. No significant loss of correction occurred during follow-up. Postoperatively, TPA improved in all groups. Nonsymptomatic loosening was noted in 59% of unit rods, 57% of iliac screws, and 52% of SAI screws. One prominent iliac screw needed removal. One nonsymptomatic rod fracture, one infected pseudarthrosis, and one rod malposition occurred in unit rod group.
CONCLUSIONS: This study suggests that for correction of pelvic obliquity in cerebral palsy scoliosis, iliac and SAI screws were similar to the unit rod in comparative effectiveness and implant safety profile.
LEVEL OF EVIDENCE: Therapeutic study, Level III.

DOI: 10.1016/j.jspd.2015.11.001
PMID: 27927506 [PubMed - in process]

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, 1year, 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.

DOI: 10.1016/j.gaitpost.2016.11.018
PMID: 27907872 [PubMed - as supplied by publisher]

Effects of lateral electrical surface stimulation on scoliosis in children with severe cerebral palsy: a pilot study.
Ko EJ, Sung IY, Yun GJ, Kang JA, Kim J, Kim GE.
Disabil Rehabil. 2016 Dec 7:1-7. [Epub ahead of print]

PURPOSE: To evaluate the effects of lateral electrical surface stimulation (LESS) on scoliosis and trunk balance in children with severe cerebral palsy (CP).
METHODS: Children with severe CP (GMFCS level IV or V) and stationary or progressive scoliosis were enrolled. Children were recommended of two sessions of LESS/day, 1 h/session, for 3 months at home: at 40-80 mA intensity, 200 μs pulse width, 25 Hz frequency, on for 6 s and then off for 6 s on the convex side of the trunk curve. Radiologic (Cobb's, kyphotic, and sacral angles) and functional [gross motor function measurement (GMFM)-88 sitting score, and trunk control measurement scale (TCMS)] measurements were evaluated at 4 periods: (a) 3 months before, (b) just before, (c) 1 month after, and (d) 3 months after LESS.
RESULTS: The median Cobb's angle of 11 children (median age, 9 years) was 25°, and it showed significant improvements after both 1 and 3 months of LESS. The LESS intensity correlated with the improvement of GMFM-88 siting score. The parents or main caregivers of the children believed LESS had several positive effects without major adverse effects.
CONCLUSIONS: LESS is effective in scoliosis in children with severe CP and it may improve trunk balance. Implications for rehabilitation Scoliosis is a very complicated problem for the children with severe CP. They do not have many options for treatments and scoliosis is usually refractory. Lateral electrical surface stimulation (LESS) is effective in scoliosis in children with severe CP and it may improve trunk balance. LESS may be another option of managing stationary or progressive scoliosis in the children with severe CP who are unable to undergo surgery.
DOI: 10.1080/09638288.2016.1250120
PMID: 27927033 [PubMed - as supplied by publisher]

Effect of Preoperative Indications Conference on Procedural Planning for Treatment of Scoliosis.
Chan CM, Swindell HW, Matsumoto H, Park HY, Hyman JE, Vitale MG, Roye DP Jr, Roye BD.
Spine Deform. 2016 Jan;4(1):27-32. doi: 10.1016/j.jspd.2015.05.003. Epub 2015 Dec 23.

STUDY DESIGN: This study determines the rate of change in the scoliosis surgery plan in cases presented in preoperative indications conference.
OBJECTIVES: To determine the effect of preoperative indications conference on the plan of surgery and to identify characteristics that increased the likelihood of change.
SUMMARY OF BACKGROUND DATA: Preoperative indications conferences are used as a teaching and planning tool. Levels of fusion, construct options, and necessity for osteotomies are often debated in the planning of scoliosis surgery.
METHODS: Scoliosis surgeries were presented at preoperative indications conference with four attending pediatric orthopedic surgeons present. The operative surgeon committed to a surgical plan before conference. A consensus-based plan was made without knowledge of the operative surgeon's preconference plan. Changes of plan were classified as major, minor, or no change.
RESULTS: Of the 107 surgical plans, 50 were index surgeries, 13 were revisions, and 44 were scheduled growing rod lengthenings. There were two major changes, including a change to a growing construct from planned fusion, and a change in fusion levels in an adolescent idiopathic scoliosis (AIS) patient. There were 13 minor changes, which included changes in fusion levels (1 to 3; mean = 1.23) and the addition of an osteotomy. The rate of change was 28% for index surgeries and 7.69% for revisions. Of the 14 changes in the 50 index surgeries, there were 8 AIS, 3 cerebral palsy, 1 congenital scoliosis, 1 Ehlers-Danlos, and 1 patient with an undetermined neuromuscular condition. There was 1 change in 13 revision surgeries. There were no changes for growing rod lengthenings and no cancellations as a result of indications conference.

CONCLUSIONS: Although revision scoliosis surgery is complex, index AIS/JIS surgery was most subject to the influence of indications conference. This likely reflects controversy around choosing levels of fusion.
LEVEL OF EVIDENCE: IV.

DOI: 10.1016/j.jspd.2015.05.003
PMID: 27852496 [PubMed - in process]

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 Ouwerkerk WJ, Strijers RL, van de Pol LA, Stadhouder 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]

BACKGROUND: 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.
AIM: To examine effects of SDR on daily care and comfort in non-walking children with severe spasticity due to different underlying neurological conditions.
METHODS: Medical history, changes in daily care and comfort and satisfaction with outcome were assessed retrospectively in non-walking children who underwent SDR in our center, with a mean follow-up of 1y 7m (range 11m-4y 3m). All eligible patients (n = 24, years 2009-2014) were included.
RESULTS: Mean age at SDR was 12y 4m (SD 4y 3m, range 2y 8m-19y 3m). 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.
INTERPRETATION: 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.

DOI: 10.1016/j.ejpn.2016.09.006
PMID: 27908676 [PubMed - as supplied by publisher]

Hallux valgus deformity correction without fusion in children with cerebral palsy.
Bayhan IA, Kadhim M, Sees JP, Nishnianidze T, Rogers KJ, Er MS, Miller F.
J Pediatr Orthop B. 2016 Dec 9. [Epub ahead of print]

This study aimed to evaluate the outcomes of nonarthrodesis surgical treatment of hallux valgus (HV) deformity in children with cerebral palsy using radiographic and gait analysis parameters. There were 25 patients who had hallux valgus correction in 39 feet. The mean age at surgery was 15±2.8 years and the mean follow-up duration was 14.6 months. The first metatarsal osteotomy was performed in nine feet, bunionectomy in 25 feet, and Aiken osteotomy in 32 feet. None had metatarsophalangeal joint fusion. We observed a significant correlation between HV correction and other foot and ankle gait parameters. Our study showed correction of HV deformity at short-term follow-up without fusion of the metatarsophalangeal joint.LEVEL OF EVIDENCE: Level IV Therapeutic Studies.
DOI: 10.1097/BPB.0000000000000419
PMID: 27941531 [PubMed - as supplied by publisher]

Health Related Quality of Life and Care Giver Burden Following Spinal Fusion in Children with Cerebral Palsy.
DiFazio R, Miller P, Vessey JA, Snyder B.
Spine (Phila Pa 1976). 2016 Oct 25. [Epub ahead of print]

STUDY DESIGN: Prospective longitudinal cohort OBJECTIVE.: Evaluate changes in caregivers' perceptions of health related quality of life (HRQOL) and caregiver burden in children with severe cerebral palsy (CP) following spinal fusion.
SUMMARY OF BACKGROUND DATA: Progressive scoliosis is common in non-ambulatory children with CP; the utility of spine fusion has been long debated and prospective evaluations of patient reported outcomes are limited. METHODS: Children 3-21 years old, GMFCS IV-V CP, scheduled for spine fusion were enrolled consecutively from September 2011-March 2014. Caregivers completed the CPCHILD and ACEND pre-operatively and at 6 weeks, 3, 6, 12, and 24 months post-operatively. Changes in CPCHILD™ and ACEND scores from pre-operative to 1 and 2 years after surgery were assessed using paired t-tests. Correlations between pre-operative Cobb angle and CPCHILD™ and ACEND scores were evaluated using Pearson's correlation analysis.
RESULTS: Twenty-six GMFCS IV-V CP patients with severe scoliosis treated with spine fusion were included. Mean age was 14 years, 50% male, 46% had instrumentation to the pelvis. Average pre-operative Cobb angle was 68.9° (SD 25.68) with an average improvement of 76%. The CPCHILD™ score increased by 9.8 points above baseline (95% CI: 3.4 to 16.2) at 1 year post-operatively ($p = 0.005$). However, at 2 years, the CPCHILD™ score regressed to baseline ($p = 0.40$). ACEND scores did not change from baseline scores at 1 year ($p = 0.09$) and 2 year (0.72) follow-up; reflecting that caregiver burden is little changed by spine fusion. While there was no correlation between pre-operative Cobb angle and CPCHILD™ score ($p = 0.52$) or ACEND score ($p = 0.56$) at 1 year or 2 year follow-up ($p = 0.69$, $p = 0.90$). Children with Cob ≤ 75° experienced more improvement 1 year after surgery than children with Cobb >75°.
CONCLUSIONS: HRQOL improves 1 year following spine fusion but regresses to baseline after 2 years. Caregiver burden was unchanged following spine fusion.
LEVEL OF EVIDENCE: 2.
DOI: 10.1097/BRS.0000000000001940
PMID: 27792122 [PubMed - as supplied by publisher]

Management of the spastic hip in cerebral palsy.
Givon U
Curr Opin Pediatr. 2016 Oct 27. [Epub ahead of print]

PURPOSE OF REVIEW: Spastic hip dysplasia (SHD) is a common finding in patients with cerebral palsy, with a higher incidence in more involved patients, causing disability and reducing quality of life in these patients. SHD is the most serious orthopedic problem seen in cerebral palsy patients, and requires special attention and tenacious evaluation of the patients. The aim of this article is to review the new developments in the treatment of SHD.
RECENT FINDINGS: Patients with cerebral palsy were shown to have better hip joint morphology when they had access to hip surveillance programmes, with proactive search of patients with progressing hip subluxation and early intervention. Prediction of progression of SHD is now available based on the experience of these programmes.Patients who underwent hip joint reconstruction showed that incongruent joints remodeled following a Dega osteotomy. Patients who underwent a varus osteotomy of the femoral neck without pelvic reconstruction had a higher rate of recurrence when they were older and the SHD was more severe. Health-related quality of life measures improved following hip joint reconstructions and salvage procedures.
CONCLUSION: Patients with cerebral palsy should be monitored with a well-defined hip surveillance programme, with early identification and timely intervention for SHD.
DOI: 10.1097/MOP.0000000000000433
PMID: 27798427 [PubMed - as supplied by publisher]

Modified Grice-Green subtalar arthrodesis performed using a partial fibular graft yields satisfactory results in patients with cerebral palsy.
Güven M, Tokyay A, Akman B, Encan ME, Altintaş F.
J Pediatr Orthop B. 2016 Mar;25(2):119-25. doi: 10.1097/BPB.0000000000000264.

The aim of this study was to report the experience with the use of a modified Grice-Green technique, which was performed using a partial subperiosteal fibular bone graft because of valgus unstable foot in children with cerebral palsy. Fifteen feet of 11 patients were evaluated on the basis of the appearance of the feet, clinical symptoms, and radiographic measurements. After an average follow-up duration of 24 (9-39) months, all feet showed satisfactory clinical and radiological results. Solid fusion and sustained correction took place in all feet. The gap at the donor site

was bridged with new bone in all cases. No donor-site morbidity was detected. This modification of the Grice-Green technique can be used effectively in the correction of planovalgus foot in cerebral palsy.
DOI: 10.1097/BPB.0000000000000264
PMID: 26683367 [PubMed - indexed for MEDLINE]

Predicting postoperative gait in cerebral palsy.
Galarraga C OA, Vigneron V, Dorizzi B, Khouri N(4), Desailly .
Gait Posture. 2016 Nov 9;52:45-51. doi: 10.1016/j.gaitpost.2016.11.012. [Epub ahead of print]

In this work, postoperative lower limb kinematics are predicted with respect to preoperative kinematics, physical examination and surgery data. Data of 115 children with cerebral palsy that have undergone single-event multilevel surgery were considered. Preoperative data dimension was reduced utilizing principal component analysis. Then, multiple linear regressions with 80% confidence intervals were performed between postoperative kinematics and bilateral preoperative kinematics, 36 physical examination variables and combinations of 9 different surgical procedures. The mean prediction errors on test vary from 4° (pelvic obliquity and hip adduction) to 10° (hip rotation and foot progression), depending on the kinematic angle. The unilateral mean sizes of the confidence intervals vary from 5° to 15°. Frontal plane angles are predicted with the lowest errors, however the same performance is achieved when considering the postoperative average signals. Sagittal plane angles are better predicted than transverse plane angles, with statistical differences with respect to the average postoperative kinematics for both plane's angles except for ankle dorsiflexion. The mean prediction errors are smaller than the variability of gait parameters in cerebral palsy. The performance of the system is independent of the preoperative state severity of the patient. Even if the system is not yet accurate enough to define a surgery plan, it shows an unbiased estimation of the most likely outcome, which can be useful for both the clinician and the patient. More patients' data are necessary for improving the precision of the model in order to predict the kinematic outcome of a large number of possible surgeries and gait patterns.

DOI: 10.1016/j.gaitpost.2016.11.012
PMID: 27871017 [PubMed - as supplied by publisher]

Pre-operative walking activity in youth with cerebral palsy.
Res Dev Disabil. 2016 Nov 29;60:77-82. doi: 10.1016/j.ridd.2016.11.011. [Epub ahead of print]
Nicholson K, Lennon N, Hulbert R, Church C, Miller F.

BACKGROUND: No data are available regarding level of walking activity for youth with cerebral palsy (CP) before undergoing orthopeadic 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.
PROCEDURES: 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.
RESULTS: 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.
CONCLUSIONS: 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.

DOI: 10.1016/j.ridd.2016.11.011
PMID: 27912105 [PubMed - as supplied by publisher]

Satisfaction and pain levels after proximal femoral valgus osteotomy according to Schanz in patients with cerebral palsy and hip dislocation.

Harmsen AM, Witbreuk MM, Pruijs HJ, Buizer AI, van der Sluijs JA.
J Pediatr Orthop B. 2016 May;25(3):222-7. doi: 10.1097/BPB.0000000000000253.

Outcome after Schanz osteotomy in the treatment of chronic hip dislocation in children with cerebral palsy was evaluated. Medical charts and questionnaires were used to assess pain, functional outcome and satisfaction. A total of 24 children, with a mean age of 13.8 years (± 8.9), were included in the study, out of which 11 were classified with Gross Motor Function Classification System (GMFCS) level IV and 13 with GMFCS level V. Current pain was comparable to patients without chronic hip dislocation, and satisfaction was intermediate. Functional outcome improved in several domains. Longer postoperative time was associated with improved pain and satisfaction. The Schanz osteotomy allowed improvement in pain levels; however, it did not completely meet caregiver's expectation and has high reoperation rates.
DOI: 10.1097/BPB.0000000000000253
PMID: 26588835 [PubMed - indexed for MEDLINE]

Selective dorsal rhizotomy as an alternative to intrathecal baclofen pump replacement in GMFCS grades 4 and 5 children.
Ingale H, Ughratdar I, Muquit S, Moussa AA, Vloeberghs MH.
Childs Nerv Syst. 2016 Feb;32(2):321-5. doi: 10.1007/s00381-015-2950-9. Epub 2015 Nov 9.

BACKGROUND: Conventionally, selective dorsal rhizotomy (SDR) has been reserved for ambulant children and implantation of intrathecal baclofen (ITB) pump for non-ambulant children with cerebral palsy. Rather than replacing the ITB pump in selected Gross Motor Function Classification System (GMFCS) grades 4 and 5 children, we elected to undertake SDR instead. We discuss the rationale and outcomes.
OBJECTIVES: To assess if children with severe spasticity treated with long-term ITB pump would benefit from SDR as alternative procedure to replacement of ITB pump.
METHOD: This study is a prospective review of ten children with severe spasticity. Indications for ITB pump replacement in 3/10 children were previous ITB pump infection and the remaining seven were nearing depletion of drug delivery system. Pre- and post-SDR mean modified Ashworth scores, assessment of urological function and survey of parent/carer satisfaction were undertaken.
RESULT: Mean Ashworth score reductions post-SDR in the lower limbs and upper limbs were 2.4 and 1.70, respectively. An improvement in urological function was also noticed in 27% of patients. Overall, 90% of parents/carers felt that functional outcome with SDR was improved compared with that of ITB.
CONCLUSION: SDR in comparison to ITB in this subgroup is cheaper, less intrusive by avoiding refills/replacement and found to be more effective than ITB in reducing spasticity and providing ease for nursing care. We therefore suggest that consideration should be given to SDR as an alternative in patients previously implanted with ITB systems complicated by infection or nearing end of battery life.
DOI: 10.1007/s00381-015-2950-9
PMID: 26552383 [PubMed - indexed for MEDLINE]

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]

Background and purpose - 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.
DOI: 10.1080/17453674.2016.1263110
PMID: 27892801 [PubMed - as supplied by publisher]

Stepwise surgical approach to equinocavovarus in patients with cerebral palsy.
Won SH, Kwon SS, Chung CY, Lee KM, Lee IH, Jung KJ, Moon SY, Chung MK, Park MS.
J Pediatr Orthop B. 2016 Mar;25(2):112-8. doi: 10.1097/BPB.0000000000000244.

This study investigated the radiologic results of a stepwise surgical approach to equinocavovarus in 24 patients with cerebral palsy and determined the extent to which each procedure affected radiographic parameters using a linear mixed model. The anteroposterior talus-first metatarsal and anteroposterior talonavicular coverage angles were improved. The calcaneal pitch angle, tibiocalcaneal angle, lateral talus-first metatarsal angle, and naviculocuboid overlap were also improved. The Dwyer sliding osteotomy affected the tibiocalcaneal angle, whereas first metatarsal dorsal wedge osteotomy improved the calcaneal pitch angle and lateral first metatarsal angle. The stepwise surgical approach is effective for correction of equinocavovarus in cerebral palsy patients.
DOI: 10.1097/BPB.0000000000000244
PMID: 26529433 [PubMed - indexed for MEDLINE]

Subclassification of GMFCS Level-5 Cerebral Palsy as a Predictor of Complications and Health-Related Quality of Life After Spinal Arthrodesis.
Jain A, Sponseller PD, Shah SA, Samdani A, Cahill PJ, Yaszay B, Njoku DB, Abel MF, Newton PO, Marks MC, Narayanan UG; Harms Study Group.
J Bone Joint Surg Am. 2016 Nov 2;98(21):1821-1828.

BACKGROUND: The Gross Motor Function Classification System (GMFCS) of cerebral palsy categorizes patients by mobility. Patients at GMFCS level 5 are considered the most disabled and at high risk of hip and spine problems, yet they represent a wide spectrum of function. Our aim was to subclassify patients at GMFCS level 5 who underwent spinal arthrodesis on the basis of central neuromotor impairments and to assess whether subclassification predicted postoperative complications and changes in health-related quality of life.
METHODS: Using a prospective cerebral palsy registry, we identified 199 patients at GMFCS level 5 who underwent spinal arthrodesis from 2008 to 2013. Patients were assigned to subgroups according to preoperative central neuromotor impairments: the presence of a gastrostomy tube, a tracheostomy, history of seizures, and nonverbal status. Nine percent of patients had 0 impairments (GMFCS level 5.0), 14% had 1 impairment (level 5.1), 26% had 2 impairments (level 5.2), and 51% had 3 or 4 impairments (level 5.3). The Caregiver Priorities and Child Health Index of Life with Disabilities (CPCHILD) questionnaire was used for preoperative and postoperative health-related quality-of-life outcome assessments, and major complications were recorded.
RESULTS: The rate of major complications increased significantly with higher GMFCS level-5 subtype ($p = 0.002$), with 12% at level 5.0, 21% at level 5.1, 31% at level 5.2, and 49% at level 5.3. Five of the 7 patients who died within the follow-up period were at level 5.3. No significant differences were found among subgroups with respect to the magnitude of correction of the major coronal curve or pelvic obliquity. Preoperative and final follow-up CPCHILD total scores decreased significantly from GMFCS level 5.0 to level 5.3. However, no significant differences were found by subgroup with respect to the magnitude of improvement in CPCHILD total scores from the preoperative to the final follow-up evaluation ($p = 0.597$).
CONCLUSIONS: Stratification based on central neuromotor impairments can help to identify patients with cerebral palsy at GMFCS level 5 who are at higher risk for developing complications after spinal arthrodesis.
LEVEL OF EVIDENCE: Prognostic Level III. See Instructions for Authors for a complete description of levels of evidence.

DOI: 10.2106/JBJS.15.01359
PMID: 27807115 [PubMed - in process]

Surgical treatment using The Unit Rod in children with neuromuscular scoliosis.
T N, I G, J L, J L, A B, I T
J Med Life. 2016 Oct-Dec;9(4):399-407.

The article represents a retrospective clinical and radiological study.
Objective. To assess the safety and the stability in time of the Unit Rod instrumentation in the treatment of severe neuromuscular scoliosis in children and adolescents. Summary. The treatment of patients with neuromuscular scoliosis always represents a challenge. The patients are debilitated and usual interventions are very long with great loss of blood. Serious complications can compromise the result of the surgery. The technique we used (the Unit Rod) is worldwide recognized, is simple, and gives excellent stability with a low rate of complications.
Methods. We conducted a clinical and radiological retrospective study with a follow-up of at least 4 years in 58 patients with serious neuromuscular conditions, most of them being non-walkers. They were surgically treated by using mostly the Unit Rod technique, in the department of Paediatric Orthopaedics of the Rouen University Hospital, France, between 2000 and 2008. The back fusion was generally from T2 to pelvis. We used the Galveston technique for the patients who needed a pelvic fixation.
Results. The mean Cobb angle correction was of 67% immediately after surgery; the correction of the curve decreased in time only in 4% of the cases. Pelvic obliquity was also very well corrected: 73% immediately and 70% at the last radiological follow-up. The mean operative time was of 175 minutes compared to 269 minutes for screws and hooks instrumentation. The most common complication for our technique was the radiolucent halo that appeared around the pelvic inserts. There was no significant degradation in time of the correction obtained. *Conclusions*. The use of this technique is safe, gives excellent results, achieving significant improvements in the postoperative functional status of the patients. The intra- and postoperative complications were minor. The advantage of using this method is the low cost of the material and technical simplicity, the corrective results being the same as the ones obtained with other techniques.
PMID: 27928445 [PubMed - in process]

Total hip replacement in young non-ambulatory cerebral palsy patients.
Morin C, Ursu C, Delecourt C.
Orthop Traumatol Surg Res. 2016 Nov;102(7):845-849. doi: 10.1016/j.otsr.2016.07.010. Epub 2016 Sep 30.

INTRODUCTION: The everyday life of a non-ambulatory adolescent or young adult with cerebral palsy can be severely impaired by a painful or stiff hip. The usual surgical solutions such as proximal femoral resection (PFR) are not entirely satisfactory for pain relief, and are mutilating.
HYPOTHESIS: A retrospective study assessed the impact of total hip replacement (THR) on such impairment, on the hypothesis that it is more effective than PFR in relieving pain, without aggravating disability.
PATIENTS AND METHODS: The surgical technique consisted in implanting a dual-mobility prosthesis with uncemented acetabular component and cemented femur, after upper femoral shaft shortening and short hip-spica cast immobilization. Forty THRs were performed in 33 patients, including 31 with multiple disability. Follow-up assessment focused on change in functional status, pain, and range of motion.
RESULTS: Mean follow-up was 5 years. Pain was more or less entirely resolved. Improvement in range of motion was less striking, and there was no significant change in functional status. There were 2 general, 2 septic and 10 mechanical complications, 6 of which required surgical revision.
DISCUSSION: In non-ambulatory cerebral palsy, THR provided much better alleviation of pain than found with PFR treatment. It should be reserved for patients able to withstand fairly long surgery and with femur size compatible with implantation of a femoral component, however small.
LEVEL OF EVIDENCE: IV, retrospective study.

DOI: 10.1016/j.otsr.2016.07.010
PMID: 27697405 [PubMed - in process]

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.
DOI: 10.5435/JAAOS-D-15-00424
PMID: 27893490 [PubMed - as supplied by publisher]

Réadaptation fonctionnelle

Astym Therapy Improves Bilateral Hamstring Flexibility and Achilles Tendinopathy in a Child with Cerebral Palsy: A Retrospective Case Report.
Scheer NA, Alstat LR, Van Zant RS.
Clin Med Insights Case Rep. 2016 Oct 20;9:95-98. eCollection 2016.

PURPOSE: The purpose of this case report was to describe the use of Astym therapy to improve hamstring flexibility and Achilles tendinopathy in a child with cerebral palsy.
CASE DESCRIPTION: An eight-year-old female with cerebral palsy was referred to physical therapy for the treatment of bilateral hamstring inflexibility and Achilles tendinopathy. Treatment focused on an Astym therapy protocol of eccentric exercise, stretching, active and passive range of motion, gait training, and a home exercise program. The patient underwent a total of 11 physical therapy treatment sessions.
OUTCOMES: At the conclusion of treatment, the patient demonstrated improved resting muscle tone in bilateral lower extremities with active 90/90 hamstring flexibility measured at 165° and ankle dorsiflexion active range of motion of 5° without pain at 0° and 90° knee flexion. The patient exhibited an improved gait pattern with even stride length and diminished genu recurvatum, decreased pain with standing and walking, discontinued use of ankle-foot orthoses, and improved activity tolerance and overall function for daily activities.
DISCUSSION: The results of this case report indicate that physical therapy rehabilitation utilizing an Astym therapy protocol can successfully achieve gains in flexibility and strength and allow for improved function of bilateral lower extremities in a patient with cerebral palsy.
CONCLUSION: Based on the findings of this case report, clinicians should consider the use of Astym therapy in treating musculoskeletal soft tissue dysfunction in pediatric patients with cerebral palsy.
Free PMC Article
DOI: 10.4137/CCRep.S40623
PMCID: PMC5074579
PMID: 27790051 [PubMed - in process]

Benefits and Enjoyment of a Swimming Intervention for Youth With Cerebral Palsy: An RCT Study.
Declerck M, Verheul M, Daly D, Sanders R.
Pediatr Phys Ther. 2016 Summer;28(2):162-9. doi: 10.1097/PEP.0000000000000235.
Comment in Pediatr Phys Ther. 2016 Summer;28(2):170.

PURPOSE: To investigate enjoyment and specific benefits of a swimming intervention for youth with cerebral palsy (CP).
METHODS: Fourteen youth with CP (aged 7 to 17 years, Gross Motor Function Classification System levels I to III) were randomly assigned to control and swimming groups. Walking ability, swimming skills, fatigue, and pain were assessed at baseline, after a 10-week swimming intervention (2/week, 40-50 minutes) or control period, after a 5-week follow-up and, for the intervention group, after a 20-week follow-up period. The level of enjoyment of each swim-session was assessed.
RESULTS: Levels of enjoyment were high. Walking and swimming skills improved significantly more in the swimming than in the control group (P = .043; P = .002, respectively), whereas fatigue and pain did not increase. After 20 weeks, gains in walking and swimming skills were retained (P = .017; P = .016, respectively).

CONCLUSION: We recommend a swimming program for youth with CP to complement a physical therapy program.
DOI: 10.1097/PEP.0000000000000235
PMID: 26871379 [PubMed - indexed for MEDLINE]

Caregiver-directed home-based intensive bimanual training in young children with unilateral spastic cerebral palsy: a randomized trial.
Ferre CL, Brandão M, Surana B, Dew AP, Moreau NG, Gordon AM.
Dev Med Child Neurol. 2016 Nov 19. doi: 10.1111/dmcn.13330. [Epub ahead of print]

AIM: To examine the efficacy of caregiver-directed, home-based intensive bimanual training in children with unilateral spastic cerebral palsy (USCP) using a randomized control trial.
METHOD: Twenty-four children (ages 2y 6mo-10y 1mo; 10 males, 14 females) performed home-based activities directed by a caregiver for 2 hours per day, 5 days per week, for 9 weeks (total=90h). Cohorts of children were age-matched into groups and randomized to receive home-based hand-arm bimanual intensive therapy (H-HABIT; n=12) or lower-limb functional intensive training (LIFT-control; n=12). Caregivers were trained before the intervention and supervised remotely via telerehabilitation. Dexterity and bimanual hand function were assessed using the Box and Blocks test (BBT) and the Assisting Hand Assessment (AHA) respectively. Caregiver perception of functional goals was measured using the Canadian Occupational Performance Measure (COPM).
RESULTS: H-HABIT showed greater improvement on the BBT compared to LIFT-control and no improvement on the AHA. H-HABIT demonstrated significant improvement in COPM-Performance compared to LIFT-control and both groups showed equal improvement in COPM-Satisfaction.
INTERPRETATION: H-HABIT improved dexterity and performance of functional goals, but not bimanual performance, in children with USCP compared to a control group receiving intervention of equal intensity/duration that also controlled for increased caregiver attention. Home-based models provide a valuable, family-centered approach to achieve increased treatment intensity.

DOI: 10.1111/dmcn.13330
PMID: 27864822 [PubMed - as supplied by publisher]

Changes in Muscle Spasticity in Patients With Cerebral Palsy After Spinal Manipulation: Case Series.
Kachmar O, Voloshyn T, Hordiyevych M.
J Chiropr Med. 2016 Dec;15(4):299-304. Epub 2016 Sep 28.

OBJECTIVE: The purpose of this case series was to report quantitative changes in wrist muscle spasticity in children with cerebral palsy after 1 spinal manipulation (SM) and a 2-week course of treatment.
METHODS: Twenty-nine patients, aged 7 to 18 years, with spastic forms of cerebral palsy and without fixed contracture of the wrist, were evaluated before initiation of treatment, after 1 SM, and at the end of a 2-week course of treatment. Along with daily SM, the program included physical therapy, massage, reflexotherapy, extremity joint mobilization, mechanotherapy, and rehabilitation computer games for 3 to 4 hours' duration. Spasticity of the wrist flexor was measured quantitatively using a Neuroflexor device, which calculates the neural component (NC) of muscle tone, representing true spasticity, and excluding nonneural components, caused by altered muscle properties: elasticity and viscosity.
RESULTS: Substantial decrease in spasticity was noted in all patient groups after SM. The average NC values decreased by 1.65 newtons (from 7.6 ± 6.2 to 5.9 ± 6.5) after 1 SM. Another slight decrease of 0.5 newtons was noted after a 2-week course of treatment. In the group of patients with minimal spasticity, the decrease in NC after the first SM was almost twofold-from 3.93 ± 2.9 to 2.01 ± 1.0. In cases of moderate spasticity, NC reduction was noted only after the 2-week course of intensive treatment.
CONCLUSIONS: In this sample of patients with cerebral palsy, a decrease in wrist muscle spasticity was noted after SM. Spasticity reduction was potentiated during the 2-week course of treatment.
DOI: 10.1016/j.jcm.2016.07.003
PMCID: PMC5106424 [Available on 2017-06-01]
PMID: 27857638 [PubMed - in process]

Comparison of a robotic-assisted gait training program with a program of functional gait training for children with cerebral palsy: design and methods of a two group randomized controlled cross-over trial.
Hilderley AJ, Fehlings D, Lee GW, Wright FV.
Springerplus. 2016 Oct 28;5(1):1886. eCollection 2016.

BACKGROUND: Enhancement of functional ambulation is a key goal of rehabilitation for children with cerebral palsy (CP) who experience gross motor impairment. Physiotherapy (PT) approaches often involve overground and treadmill-based gait training to promote motor learning, typically as free walking or with body-weight support. Robotic-assisted gait training (RAGT), using a device such as the Lokomat(®)Pro, may permit longer training duration, faster and more variable gait speeds, and support walking pattern guidance more than overground/treadmill training to further capitalize on motor learning principles. Single group pre-/post-test studies have demonstrated an association between RAGT and moderate to large improvements in gross motor skills, gait velocity and endurance. A single published randomized controlled trial (RCT) comparing RAGT to a PT-only intervention showed no difference in gait kinematics. However, gross motor function and walking endurance were not evaluated and conclusions were limited by a large PT group drop-out rate.
METHODS/DESIGN: In this two-group cross-over RCT, children are randomly allocated to the RAGT or PT arm (each with twice weekly sessions for eight weeks), with cross-over to the other intervention arm following a six-week break. Both interventions are grounded in motor learning principles with incorporation of individualized mobility-based goals. Sessions are fully operationalized through manualized, menu-based protocols and post-session documentation to enhance internal and external validity. Assessments occur pre/post each intervention arm (four time points total) by an independent assessor. The co-primary outcomes are gross motor functional ability (Gross Motor Function Measure (GMFM-66) and 6-minute walk test), with secondary outcome measures assessing: (a) individualized goals; (b) gait variables and daily walking amounts; and (c) functional abilities, participation and quality of life. Investigators and statisticians are blinded to study group allocation in the analyses, and assessors are blinded to treatment group. The primary analysis will be the pre-to post-test differences (change scores) of the GMFM-66 and 6MWT between RAGT and PT groups.
DISCUSSION: This study is the first RCT comparing RAGT to an active gait-related PT intervention in paediatric CP that addresses gait-related gross motor, participation and individualized outcomes, and as such, is expected to provide comprehensive information as to the potential role of RAGT in clinical practice.
Trial registration ClinicalTrials.gov NCT02196298.
Free PMC Article
DOI: 10.1186/s40064-016-3535-0
PMCID: PMC5084143
PMID: 27843743 [PubMed - in process]

Dance Improves Functionality and Psychosocial Adjustment in Cerebral Palsy: A Randomized Controlled Clinical Trial.
Teixeira-Machado L, Azevedo-Santos I, DeSantana JM.
Am J Phys Med Rehabil. 2016 Nov 4. [Epub ahead of print]

OBJECTIVE: This randomized controlled clinical trial aimed to investigate the effect of dance in the functionality and psychosocial adjustment of young subjects with cerebral palsy (CP).
DESIGN AND METHODS: Twenty-six young subjects with CP, GMFCS (Gross Motor Function Classification System) levels from II to V, were randomized into two intervention groups: kinesiotherapy and dance (n = 13 each). Twenty-four sessions (1 hour, twice a week) were performed in both groups. Functional Independence Measure (FIM) and World Health Organization Disability Assessment Schedule (WHODAS) by International Classification of Functioning, Disability and Health (ICF) were used before and after each intervention.
RESULTS: Dance increased the classification of functioning (P = 0.001), independence function (P = 0.004), self-care (P = 0.01), mobility (P = 0.008), locomotion (P = 0.01), communication (P = 0.02), psychosocial adjustments (P = 0.04), and cognitive function (P = 0.03). Intergroup analysis evidenced significantly greater improvements in classification of functioning (P = 0.0002), independence function (P = 0.0006), self-care (P = 0.01), mobility (P = 0.001), locomotion (P = 0.002), communication (P = 0.0001), psychosocial adjustments (P = 0.002), and cognitive function (P = 0.0001) in dance group.

CONCLUSIONS: It was shown that this approach could have an influence on basic common points in the body and motion, including emotional and social aspects, supporting the concept of complex multimodal psychomotor adjustments. Dance promoted enhancement on functionality and social activities regarding psychosocial adjustments in cerebral palsy young subjects.
DOI: 10.1097/PHM.0000000000000646
PMID: 27820729 [PubMed - as supplied by publisher]

Does Corticospinal Tract Connectivity Influence the Response to Intensive Bimanual Therapy in children With Unilateral Cerebral Palsy?
Smorenburg AR, Gordon AM, Kuo HC, Ferre CL, Brandao M, Bleyenheuft Y, Carmel JB, Friel KM
Neurorehabil Neural Repair. 2016 Nov 17. pii: 1545968316675427. [Epub ahead of print]

Background Reorganization of the corticospinal tract (CST) can occur in unilateral spastic cerebral palsy (USCP). The affected hand can be controlled via (1) typical contralateral projections from the lesioned hemisphere, (2) ipsilateral projections from the nonlesioned hemisphere, and (3) a combination of contralateral and ipsilateral projections (ie, bilateral). Intensive bimanual therapy and constraint-induced movement therapy (CIMT) improve hand function of children with USCP. Earlier it was suggested that the CST connectivity pattern may influence the efficacy of CIMT.
Objective To examine whether CST projection pattern influences the efficacy of intensive bimanual therapy in children with USCP. Participants Thirty-three children with USCP (age 8.9 ± 2.6 years, 16 females).
Methods Bimanual therapy was provided in a day-camp setting (90 hours). Participants were involved in different bimanual play and functional activities actively engaging both hands. Hand function was tested before and after the intervention with the Jebsen-Taylor Test of Hand Function, Assisting Hand Assessment, ABILHAND-Kids, and the Canadian Occupational Performance Measure. Single-pulse transcranial magnetic stimulation (TMS) was used to determine each child's CST projection pattern (ie, ipsilateral, contralateral, or bilateral).
*Result*s Children whose affected hand was controlled only by ipsilateral CST projections had worse Jebsen-Taylor Test of Hand Function and Assisting Hand Assessment scores than children in the contralateral group at baseline. Bimanual hand use and functional hand use was independent of CST projection pattern. After bimanual therapy, improvements on all outcome measures were observed, and these improvements were independent of the CST connectivity pattern.
Conclusion The efficacy of bimanual therapy on hand function in children with USCP appears to be independent of CST connectivity pattern.

DOI: 10.1177/1545968316675427
PMID: 27856938 [PubMed - as supplied by publisher]

Effects of Aquatic Intervention on Gross Motor Skills in Children with Cerebral Palsy: A Systematic Review.
Roostaei M, Baharlouei H, Azadi H, Fragala-Pinkham MA
Phys Occup Ther Pediatr. 2016 Dec 14:1-20. [Epub ahead of print]

AIMS: To review the literature on the effects of aquatic intervention on gross motor skills for children with cerebral palsy (CP).
DATA SOURCES: Six databases were searched from inception to January 2016.
REVIEW METHODS: Aquatic studies for children aged 1-21 years with any type or CP classification and at least one outcome measuring gross motor skills were included. Information was extracted on study design, outcomes, and aquatic program type, frequency, duration, and intensity. Quality was rated using the Centre of Evidence-Based Medicine: Levels of Evidence and the PEDro scale.
RESULTS: Of the 11 studies which met inclusion criteria, only two used randomized control trial design, and the results were mixed. Quality of evidence was rated as moderate to high for only one study. Most studies used quasi-experimental designs and reported improvements in gross motor skills for within group analyses after aquatic programs were held for two to three times per week and lasting for 6-16 weeks. Participants were classified according to the Gross Motor Function Classification System (GMFCS) levels I-V, and were aged 3-21 years. Mild to no adverse reactions were reported.

CONCLUSIONS: Evidence on aquatic interventions for ambulatory children with CP is limited. Aquatic exercise is feasible and adverse effects are minimal; however, dosing parameters are unclear. Further research is needed to determine aquatic intervention effectiveness and exercise dosing across age categories and GMFCS levels.
DOI: 10.1080/01942638.2016.1247938
PMID: 27967298 [PubMed - as supplied by publisher]

Effects of Combined Exercise Training on Functional Performance in Children With Cerebral Palsy: A Randomized-Controlled Study.
Peungsuwan P, Parasin P, Siritaratiwat W, Prasertnu J, Yamauchi J.
Pediatr Phys Ther. 2017 Jan;29(1):39-46.

PURPOSE: The purpose of this study was to investigate the effects of combined exercise training on functional performance in participants with cerebral palsy.
METHODS: Fifteen participants with spastic cerebral palsy were randomly allocated into either exercise or control groups. Participants in the exercise group participated in a combined strength and endurance training program for 70 minutes per day, 3 days per week, for 8 weeks, whereas those in the control group did not participate in an exercise program. Study participants in both groups continued with their regular physical therapy during the study.
RESULTS: After the 8-week training, a 6-minute walk, 30-second sit-to-stand, 10-m walk, and Functional Reach Tests, participants in the exercise group had significant improvement over their baseline values and were significantly higher than those in the control group.
CONCLUSIONS: Combined exercise training improved walking ability, functional lower limb strength, and balance in participants with cerebral palsy.
DOI: 10.1097/PEP.0000000000000338
PMID: 27984466 [PubMed - in process]

Effects of lateral electrical surface stimulation on scoliosis in children with severe cerebral palsy: a pilot study.
Ko EJ, Sung IY, Yun GJ, Kang JA, Kim J, Kim GE.
Disabil Rehabil. 2016 Dec 7:1-7. [Epub ahead of print]

PURPOSE: To evaluate the effects of lateral electrical surface stimulation (LESS) on scoliosis and trunk balance in children with severe cerebral palsy (CP).
METHODS: Children with severe CP (GMFCS level IV or V) and stationary or progressive scoliosis were enrolled. Children were recommended of two sessions of LESS/day, 1 h/session, for 3 months at home: at 40-80 mA intensity, 200 μs pulse width, 25 Hz frequency, on for 6 s and then off for 6 s on the convex side of the trunk curve. Radiologic (Cobb's, kyphotic, and sacral angles) and functional [gross motor function measurement (GMFM)-88 sitting score, and trunk control measurement scale (TCMS)] measurements were evaluated at 4 periods: (a) 3 months before, (b) just before, (c) 1 month after, and (d) 3 months after LESS.
RESULTS: The median Cobb's angle of 11 children (median age, 9 years) was 25°, and it showed significant improvements after both 1 and 3 months of LESS. The LESS intensity correlated with the improvement of GMFM-88 siting score. The parents or main caregivers of the children believed LESS had several positive effects without major adverse effects.
CONCLUSIONS: LESS is effective in scoliosis in children with severe CP and it may improve trunk balance. Implications for rehabilitation Scoliosis is a very complicated problem for the children with severe CP. They do not have many options for treatments and scoliosis is usually refractory. Lateral electrical surface stimulation (LESS) is effective in scoliosis in children with severe CP and it may improve trunk balance. LESS may be another option of managing stationary or progressive scoliosis in the children with severe CP who are unable to undergo surgery.
DOI: 10.1080/09638288.2016.1250120
PMID: 27927033 [PubMed - as supplied by publisher]

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 (F1,21=5.221, p=0.035) and step width (F1,21=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.
DOI: 10.3138/ptc.2014-77
PMCID: PMC5125476 [Available on 2017-01-01]
PMID: 27909356 [PubMed - in process]

Efficacy of the small step program in a randomised controlled trial for infants below age 12 months with clinical signs of CP; a study protocol.
Eliasson AC, Holmström L, Aarne P, Nakeva von Mentzer C, Weiland AL, Sjöstrand L, Forssberg H, Tedroff K, Löwing K
BMC Pediatr. 2016 Nov 3;16(1):175.

BACKGROUND: Children with cerebral palsy (CP) have life-long motor disorders, and they are typically subjected to extensive treatment throughout their childhood. Despite this, there is a lack of evidence supporting the effectiveness of early interventions aiming at improving motor function, activity, and participation in daily life. The study will evaluate the effectiveness of the newly developed Small Step Program, which is introduced to children at risk of developing CP during their first year of life. The intervention is based upon theories of early learning-induced brain plasticity and comprises important components of evidence-based intervention approaches used with older children with CP.
METHOD AND DESIGN: A two-group randomised control trial will be conducted. Invited infants at risk of developing CP due to a neonatal event affecting the brain will be randomised to either the Small Step Program or to usual care. They will be recruited from Astrid Lindgren Children's Hospital at regular check-up and included at age 3-8 months. The Small Step Program was designed to provide individualized, goal directed, and intensive intervention focusing on hand use, mobility, and communication in the child's own home environment and carried out by their parents who have been trained and coached by therapists. The primary endpoint will be approximately 35 weeks after the start of the intervention, and the secondary endpoint will be at 2 years of age. The primary outcome measure will be the Peabody Developmental Motor Scale (second edition). Secondary assessments will measure and describe the children's general and specific development and brain pathology. In addition, the parents' perspective of the program will be evaluated. General linear models will be used to compare outcomes between groups.
DISCUSSION: This paper presents the background and rationale for developing the Small-Step Program and the design and protocol of a randomized controlled trial. The aim of the Small Step Program is to influence development by enabling children to function on a higher level than if not treated by the program and to evaluate whether the program will affect parent's ability to cope with stress and anxiety related to having a child at risk of developing CP.
TRIAL REGISTRATION: ClinicalTrials.gov Identifier NCT02166801 . Registered June 12, 2014.
Free PMC Article
DOI: 10.1186/s12887-016-0711-x
PMCID: PMC5093986
PMID: 27809886 [PubMed - in process

High-intensity interval training to improve fitness in children with cerebral palsy.
Lauglo R, Vik T, Lamvik T, Stensvold D, Finbråten AK(2), Moholdt T.
BMJ Open Sport Exerc Med. 2016 May 9;2(1):e000111. eCollection 2016.

AIM: 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).
METHODS: 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.
RESULTS: 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.
CONCLUSIONS: 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.
TRIAL REGISTRATION NUMBER: NCT00965133.
Free PMC Article
DOI: 10.1136/bmjsem-2016-000111
PMCID: PMC5117070
PMID: 27900177 [PubMed - in process]

Intervention for an Adolescent With Cerebral Palsy During Period of Accelerated Growth.
Reubens R, Silkwood-Sherer DJ.
Pediatr Phys Ther. 2016 Spring;28(1):117-25. doi: 10.1097/PEP.0000000000000223.

PURPOSE: The purpose of this case report was to describe changes in body functions and structures, activities, and participation after a biweekly 10-week program of home physical therapy and hippotherapy using a weighted compressor belt.
PARTICIPANT: A 13-year-old boy with spastic diplegic cerebral palsy, Gross Motor Function Classification System level II, was referred because of accelerated growth and functional impairments that limited daily activities.
OUTCOME MEASURES: The Modified Ashworth Scale, passive range of motion, 1-Minute Walk Test, Timed Up and Down Stairs, Pediatric Balance Scale, Pediatric Evaluation of Disability Inventory Computer Adaptive Test, and Dimensions of Mastery Questionnaire 17 were examined at baseline, 5, and 10 weeks.
OUTCOMES: Data at 5 and 10 weeks demonstrated positive changes in passive range of motion, balance, strength, functional activities, and motivation, with additional improvements in endurance and speed after 10 weeks.
CLINICAL IMPLICATIONS: This report reveals enhanced body functions and structures and activities and improved participation and motivation.
DOI: 10.1097/PEP.0000000000000223
PMID: 27088701 [PubMed - indexed for MEDLINE]

Interventions to improve gross motor performance in children with neurodevelopmental disorders: a meta-analysis.
Lucas BR, Elliott EJ, Coggan S(6,)(8), Pinto RZ(9,)(10), Jirikowic T(11), McCoy SW(12), Latimer J(6).
BMC Pediatr. 2016 Nov 29;16(1):193.

BACKGROUND: 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.
METHODS: 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.

RESULTS: 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.
CONCLUSION: 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.
Free Article
DOI: 10.1186/s12887-016-0731-6
PMID: 27899082 [PubMed - in process]

Locomotor training through a novel robotic platform for gait rehabilitation in pediatric population: short report.
Bayón C, Lerma S, Ramírez O, Serrano JI, Del Castillo MD, Raya R, Belda-Lois JM, Martínez I, Rocon E
J Neuroeng Rehabil. 2016 Nov 14;13(1):98.

BACKGROUND: Cerebral Palsy (CP) is a disorder of posture and movement due to a defect in the immature brain. The use of robotic devices as alternative treatment to improve the gait function in patients with CP has increased. Nevertheless, current gait trainers are focused on controlling complete joint trajectories, avoiding postural control and the adaptation of the therapy to a specific patient. This paper presents the applicability of a new robotic platform called CPWalker in children with spastic diplegia.
FINDINGS: CPWalker consists of a smart walker with body weight and autonomous locomotion support and an exoskeleton for joint motion support. Likewise, CPWalker enables strategies to improve postural control during walking. The integrated robotic platform provides means for testing novel gait rehabilitation therapies in subjects with CP and similar motor disorders. Patient-tailored therapies were programmed in the device for its evaluation in three children with spastic diplegia for 5 weeks. After ten sessions of personalized training with CPWalker, the children improved the mean velocity (51.94 ± 41.97 %), cadence (29.19 ± 33.36 %) and step length (26.49 ± 19.58 %) in each leg. Post-3D gait assessments provided kinematic outcomes closer to normal values than Pre-3D assessments.
CONCLUSIONS: The results show the potential of the novel robotic platform to serve as a rehabilitation tool. The autonomous locomotion and impedance control enhanced the children's participation during therapies. Moreover, participants' postural control was substantially improved, which indicates the usefulness of the approach based on promoting the patient's trunk control while the locomotion therapy is executed. Although results are promising, further studies with bigger
sample size are required.
DOI: 10.1186/s12984-016-0206-x
PMCID: PMC5109815
PMID: 27842562 [PubMed - in process]

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]

AIM: 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.
METHOD: 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.

RESULTS: 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.
INTERPRETATION: 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.

DOI: 10.1111/dmcn.13338
PMID: 27896811 [PubMed - as supplied by publisher]

Modified Constraint-Induced Movement Therapy as a Home-Based Intervention for Children With Cerebral Palsy.
Psychouli P, Kennedy CR.
Pediatr Phys Ther. 2016 Summer;28(2):154-60. doi: 10.1097/PEP.0000000000000227.
Comment in Pediatr Phys Ther. 2016 Summer;28(2):161.

PURPOSE: This study was designed to investigate the benefit to upper limb function of a home-based version of pediatric constraint-induced movement therapy, which was delivered across 2 months.
METHODS: Nine children (mean age: 6 years, 9 months) with hemiplegic cerebral palsy participated in this A1-B-C-A2 design, where A1 and A2 were nonintervention phases. In phases B and C, participants wore a splint on the unaffected hand. In phase C, motivating feedback through a computer game was added.
RESULTS: The Melbourne Assessment of Unilateral Upper Limb Function and the Quality of Upper Extremity Skills Test scores were significantly higher at the end of phases B (P = .037 and P = .006, respectively) and C (P = .001 and P = .001, respectively). Melbourne scores remained higher at the end of phase A2 (P = .001).
CONCLUSIONS: A nonintensive form of home-based constraint-induced movement therapy was found to be effective. Improvements were larger after the second month of intervention.
DOI: 10.1097/PEP.0000000000000227
PMID: 26808960 [PubMed - indexed for MEDLINE]

Orthopaedic Management of Spasticity.
Pidgeon TS, Ramirez JM(1), Schiller JR(2).
R I Med J (2013). 2015 Dec 1;98(12):26-31.

Spasticity is a common manifestation of many neurological conditions including multiple sclerosis, stroke, cerebral palsy, traumatic brain injury, and spinal cord injuries. Management of spasticity seeks to reduce its burden on patients and to limit secondary complications. Non-operative interventions including stretching/splinting, postural management, physical therapy/strengthening, anti-spasticity medications, and botulinum toxin injections may help patients with spasticity. Surgical management of these conditions, however, is often necessary to improve quality of life and prevent complications. Orthopaedic surgeons manage numerous sequelae of spasticity, including joint contractures, hip dislocations, scoliosis, and deformed extremities. When combined with the efforts of rehabilitation specialists, neurologists, and physical/occupational therapists, the orthopaedic management of spasticity can help patients maintain and regain function and independence as well as reduce the risk of long-tem complications.
PMID: 26623452 [PubMed - indexed for MEDLINE]

Pilates improves lower limbs strength and postural control during quite standing in a child with hemiparetic cerebral palsy: A case report study.
Dos Santos AN, Serikawa SS, Rocha NA
Dev Neurorehabil. 2016 Aug;19(4):226-30. doi: 10.3109/17518423.2014.947040. Epub 2014 Sep 2.

OBJECTIVE: To verify the effect of Pilates exercises in a child with cerebral palsy (CP) with mild functional impairment.
METHODS: We evaluated average peak torque of ankle and knee extensors/flexors using a Biodex System, using concentric active-assisted test. We also evaluated amplitude of anterior-posterior and of medial-lateral displacement

of the CoP and area of oscillation during quite standing with a BERTEC platform. We applied Pilates exercises for eight weeks.
RESULTS: Peak torque/body weight of ankle and knee extensors/flexors of both affected and unaffected limbs increased after Pilates. Also, all kinetic variables decreased after Pilates' intervention. After one-month follow-up, isokinetic variable values were higher while kinetic variable values were lower than baseline values.
CONCLUSION: Pilates may be an important rehabilitation technique for children with CP that present mild deficits in motor structures and high functional level, especially when the aims are to improve muscle strength and postural control during quite standing.
DOI: 10.3109/17518423.2014.947040
PMID: 25181421 [PubMed - indexed for MEDLINE]

Remind to move - A novel treatment on hemiplegic arm functions in children with unilateral cerebral palsy: A randomized cross-over study.
Dong AQ, Fong NK
Dev Neurorehabil. 2016 Oct;19(5):275-83. doi: 10.3109/17518423.2014.988304. Epub 2014 Dec 30.

OBJECTIVE: To investigate the effects of 'remind to move' treatment on hemiplegic arm function in children with unilateral cerebral palsy (CP).
METHODOLOGY: Twelve students with unilateral CP aged 6-18 were recruited from a special school and randomly assigned into two groups. Participants in the experimental group underwent a 3-week sensory cueing treatment followed by a 3-week sham treatment. Participants in the waitlist group completed the sham treatment first followed by the sensory-cueing treatment. There was a 4-week washout period between treatments.
RESULTS: Both functional hand use and arm impairment level significantxly improved after the 3-week sensory cueing treatment for the combined sample between groups. However, no significant carryover effects were found for either treatment.
CONCLUSION: Three weeks of 'remind to move' treatment is useful in improving hemiplegic arm function and quantity of hand use in children with unilateral CP but the long-term carryover effect requires further investigation.
DOI: 10.3109/17518423.2014.988304
PMID: 25548861 [PubMed - indexed for MEDLINE]

Six-Minute Walk Test in Children With Spastic Cerebral Palsy and Children Developing Typically.
Fitzgerald D, Hickey C, Delahunt E, Walsh M, O'Brien T.
Pediatr Phys Ther. 2016 Summer;28(2):192-9. doi: 10.1097/PEP.0000000000000224
Comment in Pediatr Phys Ther. 2016 Summer;28(2):199.

PURPOSE: To quantify the 6-minute walk test (6MWT) in children with spastic cerebral palsy (CP) functioning at Gross Motor Function Classification System (GMFCS) levels I to III and to compare with a sample of children with typical development (TD).
METHODS: A total of 145 children with CP and 137 children with TD completed the 6MWT.
RESULTS: Mean 6MWT scores were 439.57 ± 49.81 m for children functioning at GMFCS level I (n = 74), 386.74 ± 66.47 m for GMFCS level II (n = 53), 305.28 ± 66.95 m for GMFCS level III (n = 18), and 528.42 ± 67.77 m for children with TD (n = 137). Results of a pair-wise comparison showed significant differences ($P < .001$) between 6MWT scores of children with CP across GMFCS levels I to III and children with TD.
CONCLUSION: A range of 6-minute walk distance reference values for children with spastic CP and children with TD were established.
DOI: 10.1097/PEP.0000000000000224
PMID: 26808959 [PubMed - indexed for MEDLINE]

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]

BACKGROUND: 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.
AIMS: We evaluate the importance of skill progression during intensive bimanual practice on movement coordination.
METHODS AND PROCEDURES: 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.
OUTCOMES AND RESULTS: 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).
CONCLUSIONS AND IMPLICATIONS: 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.

DOI: 10.1016/j.ridd.2016.11.012
PMID: 27912104 [PubMed - as supplied by publisher]

Systematic review of the effects of mirror therapy in children with cerebral palsy.
Park EJ, Baek SH, Park S
J Phys Ther Sci. 2016 Nov;28(11):3227-3231. Epub 2016 Nov 29.

[Purpose] To provide data for systematic intervention plans in occupational therapy practice by objectivity showing the value of mirror therapy interventions in children with cerebral palsy.
[Subjects and Methods] Medline and EMBASE databases were searched for the key words "cerebral palsy," "mirror movement," "mirror therapy," and "mirror visual feedback." Nine studies that met the inclusion and exclusion criteria were identified. The qualitatively determined level of evidence, period of research, comparisons and interventions, tools used to measure the intervention, and the effects were analyzed.
[Results] According to the results analyzed, one (1/9, 11.1%) study showed the same result as the control group, one (1/9, 11.1%) showed a negative effect, and seven (7/9, 77.8%) showed positive effects of mirror-mediated therapy, with meaningful improvement in function, such as hand strength, movement speed, muscle activity, and accuracy of hand matching. [Conclusion] Through this study, the value of mirror-mediated therapeutic interventions in occupational therapy practice targeting cerebral palsy was confirmed. It is expected that this result will be useful in establishing mirror therapy as an interventional program.
Free PMC Article
DOI: 10.1589/jpts.28.3227
PMCID: PMC5140834
PMID: 27942154 [PubMed - in process]

Systematic review of whole body vibration exercises in the treatment of cerebral palsy: Brief report.
Sá-Caputo D, Costa-Cavalcanti R, Carvalho-Lima RP, Arnóbio A, Bernardo RM, Ronikeile-Costa P, Kutter C, Giehl PM, Asad NR, Paiva DN, Pereira HV, Unger M, Marin PJ, Bernardo-Filho M
Dev Neurorehabil. 2016 Oct;19(5):327-33. doi: 10.3109/17518423.2014.994713. Epub 2015 Mar 31.

OBJECTIVE: Whole body vibration (WBV) is increasingly being used to improve balance and motor function and reduce the secondary complications associated with cerebral palsy (CP). The purpose of this study was to systematically appraise published research regarding the effects of static and/or dynamic exercise performed on a vibrating platform on gait, strength, spasticity and bone mineral density (BMD) within this population.
METHODS: Systematic searches of six electronic databases identified five studies that met our inclusion criteria (2 at Level II and 3 at Level III-2). Studies were analysed to determine: (a) participant characteristics; (b) optimal exercise and WBV treatment protocol; (c) effect on gait, strength, spasticity and BMD; and (d) the outcome measures used to evaluate effect. As data was not homogenous a meta-analysis was not possible.

RESULTS: Several design limitations were identified and intervention protocols are poorly described. The effects on strength, gait, spasticity and BMD in persons with CP remain inconclusive with weak evidence that WBV may improve selected muscle strength and gait parameters and that prolonged exposure may improve BMD; there is currently no evidence that WBV can reduce spasticity.
CONCLUSIONS: The evidence for exercise performed on a vibrating platform on mobility, strength, spasticity and BMD in CP remains scant and further larger scale investigations with controlled parameters to better understand the effects ofWBV exercises in this population is recommended.
DOI: 10.3109/17518423.2014.994713
PMID: 25826535 [PubMed - indexed for MEDLINE]

The effects of neck and trunk stabilization exercises on upper limb and visuoperceptual function in children with cerebral palsy.
Shin JW, Song GB
J Phys Ther Sci. 2016 Nov;28(11):3232-3235. Epub 2016 Nov 29.

[Purpose] The present study aimed to investigate the effects of neck and trunk stabilization exercises on upper limb and visuoperceptual function in children with cerebral palsy. The Jebson-Taylor hand function test and the Korean Developmental Test of Visual Perception-2 (K-DTVP-2) test were utilised.
[Subjects and Methods] The study subjects were 11 schoolchildren who had paraplegia caused by premature birth, and who had been diagnosed with periventricular leukomalacia. Kinesitherapy was implemented in individual children for eight weeks, twice a week, for 45 minutes at a time. After a preliminary evaluation, kinesitherapy, including neck and trunk stabilization exercises common to all the children, was implemented for eight weeks according to the functioning and level of each child. A post evaluation was performed after the eight weeks of kinesitherapy. [Results] The intervention showed a significant effect in five subcategories of the Jebson-Taylor hand function test, as well as according to the K-DTVP-2 test.
[Conclusion] Because neck and trunk stabilization
exercises requiring positive participation by the children included fundamental elements of daily living motion, the exercises might have had a positive effect on upper limb and visuoperceptual function.
Free PMC Article
DOI: 10.1589/jpts.28.3232
PMCID: PMC5140835
PMID: 27942155 [PubMed - in process]

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.

DOI: 10.1177/1545968316680483
PMID: 27909072 [PubMed - as supplied by publisher]

Orthèse

Are Gait Indices Sensitive Enough to Reflect the Effect of Ankle Foot Orthosis on Gait Impairment in Cerebral Palsy Diplegic Patients?
Danino B, Erel S, Kfir M, Khamis S, Batt R, Hemo Y, Wientroub S, Hayek S.
J Pediatr Orthop. 2016 Apr-May;36(3):294-8. doi: 10.1097/BPO.0000000000000429.

BACKGROUND: Neuromuscular impairments may compromise gait function in patients with cerebral palsy (CP). As such, ambulatory children with CP often use ankle foot orthosis (AFO) to facilitate and optimize their ability to walk.The aim of this study was to evaluate whether the different gait indices, the Gillette Gait Index (GGI), the Gait Deviation Index (GDI), and the Gait Profile Score (GPS), reflect the improved gait that was previously shown using AFO.
METHODS: A retrospective analysis of 53 studies on children with spastic diplegic CP. All had undergone a comprehensive gait study and were analyzed while walking, both barefoot and with their braces, in the same session.Kinematic and temporal spatial data were determined and summarized by 3 methods: GPS, GDI, and GGI.
RESULTS: Significant differences were found between the barefoot condition and the AFO conditions for temporal and kinematic parameters: changes in GGI, GDI, and GPS were not statistically significant, with an improvement of 9.33% in GGI (P=0.448) and no change in GDI and GPS.
CONCLUSIONS: The use of AFO in diplegic CP children caused a statistically significant improvement in temporal and kinematic parameters. Interestingly, it was found that this improvement was not reflected by GGI, GDI, or GPS.These findings might suggest that gait indices, as outcome measures, may sometimes not reflect all the effects of specific interventions.
LEVEL OF EVIDENCE: Level III-retrospective study.
DOI: 10.1097/BPO.0000000000000429
PMID: 25757205 [PubMed - indexed for MEDLINE]

Effect of Dynamic Elastomeric Fabric Orthoses on Postural Control in Children With Cerebral Palsy.
Bahramizadeh M, Rassafiani M, Aminian G, Rashedi V, Farmani F, Mirbagheri SS.
Pediatr Phys Ther. 2015 Winter;27(4):349-54. doi: 10.1097/PEP.0000000000000171.
Comment in Pediatr Phys Ther. 2015 Winter;27(4):355.

PURPOSE: The aim of this study was to evaluate the effect of dynamic elastomeric fabric orthoses (DEFOs) on postural control in children with cerebral palsy (CP).
METHODS: Ten children with spastic diplegic CP and 10 children with typical development participated. Knee extension was measured using electrogoniometry. The standard deviation of excursion and phase plane portraits of velocity in the anteroposterior and mediolateral directions were calculated from force platform signals as center of pressure parameters with or without a DEFO.
RESULTS: Maximum standing knee extension for children with CP improved after 6 weeks of wearing DEFOs ($P < .05$). Center of pressure parameters did not improve when comparing pre- to 6 weeks post-DEFO use ($P < .05$).
CONCLUSION: The DEFO can reduce the crouch position without any negative effect on postural stability in children with CP. However, postural control does not improve in a 6-week timeframe.
DOI: 10.1097/PEP.0000000000000171
PMID: 26397077 [PubMed - indexed for MEDLINE]

Evaluating the Effects of Ankle Foot Orthosis Mechanical Property Assumptions on Gait Simulation Muscle Force Results.
Hegarty AK, Petrella AJ, Kurz MJ, Silverman AK

J Biomech Eng. 2016 Dec 17. doi: 10.1115/1.4035472. [Epub ahead of print]

Musculoskeletal modeling and simulation techniques have been used to gain insights into movement disabilities for many populations, such as ambulatory children with cerebral palsy (CP). The individuals who can benefit from these techniques are often limited to those who can walk without assistive devices, due to challenges in accurately modeling these devices. Specifically, many children with CP require the use of ankle-foot orthoses (AFOs) to improve their walking ability, and modeling these devices is important to understand their role in walking mechanics. The purpose of this study was to quantify the effects of AFO mechanical property assumptions, including rotational stiffness, damping and equilibrium angle of the ankle and subtalar joints, on the estimation of lower-limb muscle forces during stance for children with CP. We analyzed two walking gait cycles for two children with CP while they were wearing their own prescribed AFOs. We generated 1000-trial Monte Carlo simulations for each of the walking gait cycles, resulting in a total of 4000 walking simulations. We found AFO mechanical property assumptions influenced the force estimates for all muscles, with the ankle muscles having the largest resulting variability. Muscle forces were most sensitive to assumptions of AFO ankle and subtalar stiffness, which should therefore be measured when possible. Muscle force estimates were less sensitive to estimates of damping and equilibrium angle. When stiffness measurements are not available, limitations on the accuracy of muscle force estimates for all muscles in the model, especially the ankle muscles, should be acknowledged.
DOI: 10.1115/1.4035472
PMID: 27987301 [PubMed - as supplied by publisher]

Measuring wearing time of knee-ankle-foot orthoses in children with cerebral palsy: comparison of parent-report and objective measurement.
Maas JC, Dallmeijer AJ, Oudshoorn BY, Bolster EA, Huijing PA, Jaspers RT, Becher JG
Disabil Rehabil. 2016 Dec 7:1-6. [Epub ahead of print]

Purpose state: Orthotic wearing time may be an important confounder in efficacy studies of treatment in children with spastic cerebral palsy (SCP). Most studies measure parent-reported wearing time (WTparent) with questionnaires, but it is questionable whether this yields valid results. This study aims to compare WTparent with objectively measured wearing time (WTobj) in children with SCP receiving orthotic treatment.METHOD: Eight children with SCP participated in this observational study. For one year, they received knee-ankle-foot orthosis (KAFO) treatment. WTparent was measured using questionnaires. WTobj was measured using temperature sensor-data-loggers that were attached to the KAFOs. The 2.5th and 97.5th percentiles and median of differences between methods (per participant) were used to calculate limits of agreement and systematic differences.
RESULTS: There was no systematic difference between WTparent and WTobj (0.1 h per week), but high inter-individual variation of the difference was found, as reflected by large limits of agreement (lower limit/2.5th percentile: -1.7 h/week; upper limit/97.5th percentile: 11.1 h/week).
CONCLUSIONS: Parent-reported wearing time (WTparent) of a KAFO differs largely from objectively measured wearing time (WTobj) using temperature sensors. Therefore, parent-reported wearing time (WTparent) of KAFOs should be interpreted with utmost care. Implications for Rehabilitation Low wearing time of orthoses may be a cause of inefficacy of orthotic treatment and incorrect reported wearing time may bias results of efficacy studies. Results of this study show that parent-reported wearing time is not in agreement with objectively measured wearing time. Parent-reported wearing time of KAFOs should be interpreted with utmost care. Objective methods are recommended for measuring orthotic wearing time.
DOI: 10.1080/09638288.2016.1258434
PMID: 27927029 [PubMed - as supplied by publisher]

The Effect of Ankle-Foot Orthoses on Community-Based Walking in Cerebral Palsy: A Clinical Pilot Study.
Bjornson K, Zhou C, Fatone S, Orendurff M, Stevenson R, Rashid S.
*Pediatr Phys Ther. 2016 Summer;28(2):179-86. doi: 10.1097/*PEP.0000000000000242.
Comment in Pediatr Phys Ther. 2016 Summer;28(2):186.

PURPOSE: To examine the effect of ankle-foot orthoses (AFO) on walking activity in children with cerebral palsy (CP).
METHODS: We used a randomized cross-over design with 11 children with bilateral CP, mean age 4.3 years. Subjects were randomized to current AFO-ON or AFO-OFF for 2 weeks and then crossed over. Walking activity (average total

steps/day), intensity, and stride rate curves were collected via an ankle accelerometer. Group effects were examined with the Wilcoxon signed-rank test and within-subject effects examined for more than 1 standard deviation change.
RESULTS: No significant group difference was found in average total daily step count between treatment conditions (P = .48). For the AFO-ON condition, 2 subjects (18%) increased total steps/day; 4 (36%) increased walking time; 2 (18%) had more strides at a rate of more than 30 strides/min; and 2 (18%) reached higher peak intensity.
CONCLUSIONS: Clinically prescribed AFO/footwear did not consistently enhance walking activity levels or intensity. Larger studies are warranted.
DOI: 10.1097/PEP.0000000000000242
PMCID: PMC4811757 [Available on 2017-07-01]
PMID: 26901534 [PubMed - indexed for MEDLINE]

Robots – Exosquelette

Planning, execution and monitoring of physical rehabilitation therapies with a robotic architecture.
González JC, Pulido JC, Fernández F, Suárez-Mejías C
Stud Health Technol Inform. 2015;210:339-43.

Traditional methods of rehabilitation require continuous attention of therapists during the therapy sessions. This is a hard and expensive task in terms of time and effort. In many cases, the therapeutic objectives cannot be achieved due to the overwork or the difficulty for therapists to plan accurate sessions according to the medical criteria. For this purpose, a wide range of studies is opened in order to research new ways of rehabilitation, as in the field of social robotics. This work presents the current state of the THERAPIST project. Our main goal is to develop a cognitive architecture which provides a robot with enough autonomy to carry out an upper-limb rehabilitation therapy for patients with physical impairments, such as Cerebral Palsy and Obstetric Brachial Plexus Palsy.
PMID: 25991162 [PubMed - indexed for MEDLINE]

Robot-assisted gait training might be beneficial for more severely affected children with cerebral palsy.
van Hedel HJ, Meyer-Heim A, Rüsch-Bohtz C
Dev Neurorehabil. 2016 Dec;19(6):410-415. Epub 2015 Apr 2.

PURPOSE: Robot-assisted gait training (RAGT) can complement conventional therapies in children with cerebral palsy. We investigated changes in walking-related outcomes between children with different Gross Motor Function Classification System (GMFCS) levels and the dose-response relationship.
METHODS: Data from 67 children (3.9-19.9 years) with GMFCS levels II-IV were evaluated retrospectively. Every child received RAGT with the Lokomat complementing a multidisciplinary rehabilitation program. Changes in various walking-related outcomes were assessed.
RESULTS: Walking-related outcomes did not improve differently between GMFCS level groups. Significant within-group improvements were mainly observed in children with GMFCS level IV. A dose-response relationship was present for children with GMFCS levels III and IV.
CONCLUSIONS: Our results indicated that, although children with a GMFCS level IV walked less during an average Lokomat session, they experienced significant improvements in walking-related outcomes. Further, training dose correlated with changes in walking-related outcomes. However, between-group differences in changes in walking-related outcomes were not significant.
DOI: 10.3109/17518423.2015.1017661
PMID: 25837449 [PubMed - indexed for MEDLINE]

Stimulation cérébrale - Stimulation neurosensorielle

Clinical usefulness of brain-computer interface-controlled functional electrical stimulation for improving brain activity in children with spastic cerebral palsy: a pilot randomized controlled trial.
Kim TW, Lee BH
J Phys Ther Sci. 2016 Sep;28(9):2491-2494. Epub 2016 Sep 29.

[Purpose] Evaluating the effect of brain-computer interface (BCI)-based functional electrical stimulation (FES) training on brain activity in children with spastic cerebral palsy (CP) was the aim of this study.
[Subjects and Methods] Subjects were randomized into a BCI-FES group (n=9) and a functional electrical stimulation (FES) control group (n=9). Subjects in the BCI-FES group received wrist and hand extension training with FES for 30 minutes per day, 5 times per week for 6 weeks under the BCI-based program. The FES group received wrist and hand extension training with FES for the same amount of time. Sensorimotor rhythms (SMR) and middle beta waves (M-beta) were measured in frontopolar regions 1 and 2 (Fp1, Fp2) to determine the effects of BCI-FES training. [Results] Significant improvements in the SMR and M-beta of Fp1 and Fp2 were seen in the BCI-FES group. In contrast, significant improvement was only seen in the SMR and M-beta of Fp2 in the control group. [Conclusion] The results of the present study suggest that BCI-controlled FES training may be helpful in improving brain activity in patients with cerebral palsy and may be applied as effectively as traditional FES training.
Free PMC Article
DOI: 10.1589/jpts.28.2491
PMCID: PMC5080159
PMID: 27799677 [PubMed - in process]

Contralesional Corticomotor Neurophysiology in Hemiparetic Children With Perinatal Stroke: Developmental Plasticity and Clinical Function.
Zewdie E, Damji O, Ciechanski P, Seeger T, Kirton A
Neurorehabil Neural Repair. 2016 Nov 23. pii: 1545968316680485. [Epub ahead of print]

Background Perinatal stroke causes most hemiparetic cerebral palsy. Ipsilateral connections from nonlesioned hemisphere to affected hand are common. The nonlesioned primary motor cortex (M1) determines function and is a potential therapeutic target but its neurophysiology is poorly understood.
Objective We aimed to characterize the neurophysiological properties of the nonlesioned M1 in children with perinatal stroke and their relationship to clinical function.
Methods Fifty-two participants with hemiparetic cerebral palsy and magnetic resonance imaging-confirmed perinatal stroke and 40 controls aged 8 to 18 years completed the same transcranial magnetic stimulation (TMS) protocol. Single-pulse TMS to nonlesioned M1 determined rest and active motor thresholds (RMT/AMT), motor-evoked potential (MEP) latencies, and stimulus recruitment curves (SRC: 100%-150% RMT). Paired-pulse TMS evaluated short-latency intracortical inhibition (SICI) and intracortical facilitation (ICF). Ipsilateral (IP) participants (ipsilateral MEP ≥0.05 mV in ≥5/20 trials) were compared with contralateral MEP only, nonipsilateral (NI) participants. Assisting Hand and Melbourne assessments quantified clinical function.
Results Twenty-five IP were compared with 13 NI (n = 38, median age 12 years, 66% male). IP had lower motor function. SRC to unaffected hand were comparable between IP and NI while IP had smaller ipsilateral SRC. Ipsilateral MEP latencies were prolonged (23.5 ± 1.8 vs 22.2 ±1.5 ms contra, P < .001). Contralateral SICI was different between IP (-42%) and NI (-20%). Ipsilateral SICI was reduced (-20%). Contralateral ICF was comparable between groups (+43%) and ipsilaterally (+43%). Measures correlated between contralateral and ipsilateral sides. Conclusion Neurophysiology of nonlesioned M1 and its relationship to motor function is measureable in children with perinatal stroke. Correlation of excitability and intracortical circuitry measures between contralateral and ipsilateral sides suggests common control mechanisms.

DOI: 10.1177/1545968316680485
PMID: 27885162 [PubMed - as supplied by publisher]

Dynamic modulation of rTMS on functional connectivity and functional network connectivity to children with cerebral palsy: a case report.
Guo Z, Xing G, He B, Chen H, Ou J, McClure MA, Liu H, Wang Y, Mu Q.
Neuroreport. 2016 Mar 2;27(4):284-8. doi: 10.1097/WNR.0000000000000534.

Repetitive transcranial magnetic stimulation (rTMS) is a noninvasive treatment tool for the recovery of cerebral palsy (CP). This report describes the modulation effect of rTMS to functional connectivity, functional network connectivity, motor, and cognitive ability following treatment in a child with mild ataxia CP. After receiving 8 months of 0.5 Hz rTMS treatment over the right dorsolateral prefrontal cortex, the child showed a gradual improvement in motor and

cognitive-related functional connectivity and functional network connectivity following treatment as well as improved motor, cognitive functions. These pilot results provide the first evidence of the efficiency of 0.5 Hz of rTMS on a child with CP. Further large sample studies are needed to verify and expand the present findings.
DOI: 10.1097/WNR.0000000000000534
PMID: 26825348 [PubMed - indexed for MEDLINE]

Effect of a single session of transcranial direct-current stimulation on balance and spatiotemporal gait variables in children with cerebral palsy: A randomized sham-controlled study.

Grecco LA, Duarte NA, Zanon N, Galli M, Fregni F, Oliveira CS
Braz J Phys Ther. 2014 Sep-Oct;18(5):419-27. Epub 2014 Oct 10.

BACKGROUND: Transcranial direct-current stimulation (tDCS) has been widely studied with the aim of enhancing local synaptic efficacy and modulating the electrical activity of the cortex in patients with neurological disorders.
OBJECTIVE: The purpose of the present study was to determine the effect of a single session of tDCS regarding immediate changes in spatiotemporal gait and oscillations of the center of pressure (30 seconds) in children with cerebral palsy (CP).
METHOD: A randomized controlled trial with a blinded evaluator was conducted involving 20 children with CP between six and ten years of age. Gait and balance were evaluated three times: Evaluation 1 (before the stimulation), Evaluation 2 (immediately after stimulation), and Evaluation 3 (20 minutes after the stimulation). The protocol consisted of a 20-minute session of tDCS applied to the primary motor cortex at an intensity of 1 mA. The participants were randomly allocated to two groups: experimental group - anodal stimulation of the primary motor cortex; and control group - placebo transcranial stimulation.
RESULTS: Significant reductions were found in the experimental group regarding oscillations during standing in the anteroposterior and mediolateral directions with eyes open and eyes closed in comparison with the control group ($p<0.05$). In the intra-group analysis, the experimental group exhibited significant improvements in gait velocity, cadence, and oscillation in the center of pressure during standing ($p<0.05$). No significant differences were found in the control group among the different evaluations.
CONCLUSION: A single session of tDCS applied to the primary motor cortex promotes positive changes in static balance and gait velocity in children with cerebral palsy.
Free PMC Article
PMCID: PMC4228627
PMID: 25372004 [PubMed - indexed for MEDLINE]

Stable cognitive functioning with improved perceptual reasoning in children with dyskinetic cerebral palsy and other secondary dystonias after deep brain stimulation.

Owen T, Adegboye D, Gimeno H, Selway R, Lin JP
Eur J Paediatr Neurol. 2016 Oct 21. pii: S1090-3798(16)30186-6. doi: 10.1016/j.ejpn.2016.10.003. [Epub ahead of print

BACKGROUND: Dystonia is characterised by involuntary movements (twisting, writhing and jerking) and postures. Secondary dystonias are described as a heterogeneous group of disorders with both exogenous and endogenous causes. There is a growing body of literature on the effects of deep brain stimulation (DBS) surgery on the motor function in childhood secondary dystonias, however research on cognitive function after DBS is scarce.
METHODS: Cognitive function was measured in a cohort of 40 children with secondary dystonia following DBS surgery using a retrospective repeated measures design. Baseline pre-DBS neuropsychological measures were compared to scores obtained at least one year following DBS. Cognitive function was assessed using standardised measures of intellectual ability and memory.
RESULTS: There was no significant change in the assessed domains of cognitive function following DBS surgery. A significant improvement across the group was found on the Picture Completion subtest, measuring perceptual reasoning ability, following DBS.
CONCLUSION: Cognition remained stable in children with secondary dystonia following DBS surgery, with some improvements noted in a domain of perceptual reasoning. Further research with a larger sample is necessary to further explore this, in particular to further subdivide this group to account for its heterogeneity. This preliminary

data has potentially positive implications for the impact of DBS on cognitive functioning within the childhood secondary dystonia population.

DOI: 10.1016/j.ejpn.2016.10.003
PMID: 27836441 [PubMed - as supplied by publisher]

Transcranial direct current stimulation for children with perinatal stroke and hemiparesis.
Kirton A, Ciechanski 2, Zewdie E, Andersen J, Nettel-Aguirre A, Carlson H, Carsolio L, Herrero M, Quigley J, Mineyko A, Hodge J, Hill M
Neurology. 2016 Dec 7. pii: 10.1212/WNL.0000000000003518. [Epub ahead of print]

OBJECTIVE: To determine whether the addition of transcranial direct current stimulation (tDCS) to intensive therapy increases motor function in children with perinatal stroke and hemiparetic cerebral palsy.
METHODS: This was a randomized, controlled, double-blind clinical trial. Participants were recruited from a population-based cohort with MRI-classified unilateral perinatal stroke, age of 6 to 18 years, and disabling hemiparesis. All completed a goal-directed, peer-supported, 2-week after-school motor learning camp (32 hours of therapy). Participants were randomized 1:1 to 1 mA cathodal tDCS over the contralesional primary motor cortex (M1) for the initial 20 minutes of daily therapy or sham. Primary subjective (Canadian Occupational Performance Measure [COPM]), objective (Assisting Hand Assessment [AHA]), safety, and secondary outcomes were measured at 1 week and 2 months after intervention. Analysis was by intention to treat.
RESULTS: Twenty-four participants were randomized (median age 11.8 ± 2.7 years, range 6.7-17.8). COPM performance and satisfaction scores doubled at 1 week with sustained gains at 2 months ($p < 0.001$). COPM scores increased more with tDCS compared to sham control ($p = 0.004$). AHA scores demonstrated only mild increases at both time points with no tDCS effects. Procedures were safe and well tolerated with no decrease in either arm function or serious adverse events.
CONCLUSION: tDCS trials appear feasible and safe in hemiparetic children. Lack of change in objective motor function may reflect underdosing of therapy. Marked gains in subjective function with tDCS warrant further study.
CLINICALTRIALSGOV IDENTIFIER: NCT02170285.
CLASSIFICATION OF EVIDENCE: This study provides Class II evidence that for children with perinatal stroke and hemiparetic cerebral palsy, the addition of tDCS to moderate-dose motor learning therapy does not significantly improve motor function as measured by the AHA.

DOI: 10.1212/WNL.0000000000003518
PMID: 27927938 [PubMed - as supplied by publisher]

Réalité virtuelle - Jeux video

Does Nintendo Wii Balance Board improve standing balance? A randomised controlled trial in children with cerebral palsy.
Gatica-Rojas V, Méndez-Rebolledo G, Guzman-Muñoz E, Soto-Poblete A, Cartes-Velásquez R, Elgueta-Cancino E, Cofré Lizama E.
Eur J Phys Rehabil Med. 2016 Nov 24. [Epub ahead of print]

BACKGROUND: Evidence on the effect of systemic exercise programs to improve the standing balance with the Nintendo Wii system is very limited and its post- treatment effectiveness is unknown in cerebral palsy (CP) patients.
AIM: Primary aim was to compare the effect of Nintendo Wii balance board (Wii-therapy) and standard physiotherapy (SPT), on the performance of standing balance in children and adolescents with CP. Secondary aim was to determine the post-treatment effectiveness of Wii-therapy and SPT.
DESIGN: Two-arm, matched-pairs, parallel-groups, randomized, controlled clinical trial.
SETTING: Outpatient Rehabilitation Centre in the city of Talca.
POPULATION: Patients with CP type spastic hemiplegia (SHE) and spastic diplegia (SDI), aged 7 to 14 years, and level I or II of GMFCS or GMFCS-ER. Were excluded patients with FSIQ <80, epilepsy, previous surgeries and application of Botulinum Toxin-A in the lower limb, uncorrected vision and hearing disorders.

METHODS: Thirty-two CP patients (10.7±3.2 years old) were randomly assigned to either Wii-therapy (SDI=7; SHE=9) or SPT intervention (SDI=7; SHE=9). In each group, patients received three sessions per week over a period of 6 weeks. Standing balance was assessed at baseline and every 2 weeks. Additionally, two follow-up assessments (4 additional weeks) were performed to determine post-treatment effectiveness. Standing balance was quantified on force platform obtaining the outcomes area of centre-of-pressure (CoP) sway (CoPSway), standard deviation in the medial-lateral (SDML) and the anterior-posterior (SDAP) directions, and velocity in both directions (VML and VAP).
RESULTS: Compared to SPT, Wii-therapy significantly reduced the CoPSway (p=0.02) and SDAP in the eyes-open condition (p=0.01). However, the effects wane after 2-4 weeks. Post hoc analysis revealed that only SHE children benefited from
Wii-therapy.
CONCLUSION: Wii-therapy was better than SPT in improving standing balance in patients with CP, but improves the balance only in SHE patients. Also, Wii-therapy effectiveness waned 2-4 weeks after the end the intervention.
CLINICAL REHABILITATION IMPACT: A systematic exercise program like Wii- therapy using the Nintendo Wii Balance Board device can be considered to improves the standing balance in patients with CP, specifically in the SHE type. This program is easy to transfer to physiotherapists and rehabilitation centres.
Free Article
PMID: 27882910 [PubMed - as supplied by publisher]

Effects of Nintendo Wii-Fit(®) video games on balance in children with mild cerebral palsy.
Tarakci D, Ersoz Huseyinsinoglu B, Tarakci E, Razak Ozdincler A
Pediatr Int. 2016 Oct;58(10):1042-1050. doi: 10.1111/ped.12942. Epub 2016 Aug 23.

BACKGROUND: This study compared the effects of Nintendo Wii-Fit(®) balance-based video games and conventional balance training in children with mild cerebral palsy (CP).
METHODS: This randomized controlled trial involved 30 ambulatory pediatric patients (aged 5-18 years) with CP. Participants were randomized to either conventional balance training (control group) or to Wii-Fit balance-based video games training (Wii group). Both group received neuro-developmental treatment (NDT) during 24 sessions. In addition, while the control group received conventional balance training in each session, the Wii group played Nintendo Wii Fit games such as ski slalom, tightrope walk and soccer heading on balance board. Primary outcomes were Functional Reach Test (forward and sideways), Sit-to-Stand Test and Timed Get up and Go Test. Nintendo Wii Fit balance, age and game scores, 10 m walk test, 10-step climbing test and Wee-Functional Independence Measure (Wee FIM) were secondary outcomes.
RESULTS: After the treatment, changes in balance scores and independence level in activities of daily living were significant ($P < 0.05$) in both groups. Statistically significant improvements were found in the Wii-based game group compared with the control group in all balance tests and total Wee FIM score ($P < 0.05$).
CONCLUSION: Wii-fit balance-based video games are better at improving both static and performance-related balance parameters when combined with NDT treatment in children with mild CP.

DOI: 10.1111/ped.12942
PMID: 26858013 [PubMed - in process]

[Impact of a virtual reality-based intervention on motor performance and balance of a child with cerebral palsy: a case study]. [Article in Portuguese]
Pavão SL, Arnoni JL, de Oliveira Ak, Rocha NA
Rev Paul Pediatr. 2014 Dec;32(4):389-94. doi: 10.1016/j.rpped.2014.04.005.

OBJECTIVE: To verify the effect of an intervention protocol using virtual reality (VR) on the motor performance and balance of a child with cerebral palsy (CP).
CASE DESCRIPTION: To comply with the proposed objectives, a 7-year old child with spastic hemiplegic cerebral palsy (cP), GMFcS level I, was submitted to a physiotherapy intervention protocol of 12 45-minute sessions, twice a week, using virtual reality-based therapy. The protocol used a commercially-available console (XBOX(®)360 Kinect(®)) able to track and reproduce body movements on a screen. Prior to the intervention protocol, the child was evaluated using the Motor Development Scale (MDS) and the Pediatric Balance Scale (PBS) in order to assess motor development and balance, respectively. Two baseline assessments with a 2-week interval between each other were

carried out for each tool. Then, the child was re-evaluated after the twelfth session. The results showed no changes in the two baseline scores. After the intervention protocol, the child improved his scores in both tools used: the PBS score increased by 3 points, reaching the maximal score, and the MDS increased from a much inferior motor performance to just an inferior motor performance.
COMMENTS: The evidence presented in this case supports the use of virtual reality as a promising tool to be incorporated into the rehabilitation process of patients with neuromotor dysfunction.

Free PMC Article
DOI: 10.1016/j.rpped.2014.04.005
PMCID: PMC4311794
PMID: 25511004 [PubMed - indexed for MEDLINE]

The effects of virtual reality-based bilateral arm training on hemiplegic children's upper limb motor skills.
Do JH, Yoo EY, Jung MY, Park HY
NeuroRehabilitation. 2016;38(2):115-27. doi: 10.3233/NRE-161302.

BACKGROUND: Hemiplegic cerebral palsy is a neurological symptom appearing on the unilateral arm and leg of the body that causes affected upper/lower limb muscle weakening and dysesthesia and accompanies tetany and difficulties in postural control due to abnormal muscle tone, and difficulties in body coordination.
OBJECTIVES: The purpose of this study was to examine the impact of virtual reality-based bilateral arm training on the motor skills of children with hemiplegic cerebral palsy, in terms of their upper limb motor skills on the affected side, as well as their bilateral coordination ability.
METHODS: The research subjects were three children who were diagnosed with hemiplegic cerebral palsy. The research followed an ABA design, which was a single-subject experimental design. The procedure consisted of a total of 20 sessions, including four during the baseline period (A1), 12 during the intervention period (B), and four during the baseline regression period (A2), For the independent variable bilateral arm training based on virtual reality, Nintendo Wii game was played for 30 minutes in each of the 12 sessions. For the dependent variables of upper limb motor skills on the affected side and bilateral coordination ability, a Wolf Motor Function Test (WMFT) was carried out for each session and the Pediatric Motor Activity Log (PMAL) was measured before and after the intervention, as well as after the baseline regression period. To test bilateral coordination ability, shooting baskets in basketball with both hands and moving large light boxes were carried out under operational definitions, with the number of shots and time needed to move boxes measured. The results were presented using visual graphs and bar graphs.
RESULTS: The study's results indicated that after virtual reality-based bilateral arm training, improvement occurred in upper limb motor skills on the affected sides, and in bilateral coordination ability, for all of the research subjects. Measurements of the effects of sustained therapy after completion of the intervention, during the baseline regression period, revealed that upper limb motor skills on the affected side and bilateral coordination ability were better than in the baseline period for all subjects.
CONCLUSION: This study confirmed that for children with hemiplegic with cerebral palsy, bilateral arm training based on virtual reality can be an effective intervention method for enhancing the upper limb motor skills on the affected side, as well as bilateral coordination ability.
DOI: 10.3233/NRE-161302
PMID: 26923353 [PubMed - indexed for MEDLINE]

The use of commercial video games in rehabilitation: a systematic review.
Bonnechère B(1), Jansen B, Omelina L, Van Sint Jan S.
Int J Rehabil Res. 2016 Dec;39(4):277-290.

The aim of this paper was to investigate the effect of commercial video games (VGs) in physical rehabilitation of motor functions. Several databases were screened (Medline, SAGE Journals Online, and ScienceDirect) using combinations of the following free-text terms: commercial games, video games, exergames, serious gaming, rehabilitation games, PlayStation, Nintendo, Wii, Wii Fit, Xbox, and Kinect. The search was limited to peer-reviewed English journals. The beginning of the search time frame was not restricted and the end of the search time frame was 31 December 2015. Only randomized controlled trial, cohort, and observational studies evaluating the effect of

VGs on physical rehabilitation were included in the review. A total of 4728 abstracts were screened, 275 were fully reviewed, and 126 papers were eventually included. The following information was extracted from the selected studies: device type, number and type of patients, intervention, and main outcomes. The integration of VGs into physical rehabilitation has been tested for various pathological conditions, including stroke, cerebral palsy, Parkinson's disease, balance training, weight loss, and aging. There was large variability in the protocols used (e.g. number of sessions, intervention duration, outcome measures, and sample size). The results of this review show that in most cases, the introduction of VG training in physical rehabilitation offered similar results as conventional therapy. Therefore, VGs could be added as an adjunct treatment in rehabilitation for various pathologies to stimulate patient motivation. VGs could also be used at home to maintain rehabilitation benefits.
DOI: 10.1097/MRR.0000000000000190
PMID: 27508968 [PubMed - in process]

Understanding Engagement in Home-Based Interactive Computer Play: Perspectives of Children With Unilateral Cerebral Palsy and Their Caregivers.

James S, Ziviani J, King G, Boyd RN

Phys Occup Ther Pediatr. 2016 Nov;36(4):343-58. doi: 10.3109/01942638.2015.1076560. Epub 2015 Nov 25.
Comment in Phys Occup Ther Pediatr. 2016 Nov;36(4):359-62.
Comment on Disabil Rehabil. 2015;37(15):1372-81.

AIMS: This study aimed to understand engagement of children in a home-based computer program, "Move it to improve it" (Mitii™), designed to enhance motor, cognitive and visual perceptual skills.
METHODS: Participants were 10 children with unilateral cerebral palsy involved in the 20-week Mitii™ program (mean age = 11 years; 5 males) and their caregivers. Semi-structured interviews were audio recorded, transcribed verbatim and analyzed independently by two researchers. Themes were identified using an inductive approach to identify themes, and mapped against an engagement framework. (King et al., 2014).
RESULTS: Key themes were: (1) Child/family characteristics: children's interest captured through novelty and technology, motivation declines as novelty wears off, children require "finely tuned" programs, strong family support facilitates engagement, and children develop confidence and ownership; (2) Intervention characteristics: increased therapy frequency with reduced caregiver involvement, Mitii™ "becomes therapy" and competes with other interests; convenience within family routine, lack of real-time feedback and technical issues, and therapist guidance is essential; and (3) Service provider characteristics: initial and ongoing therapist input, family-friendly therapy approach, and tailored strategies to sustain engagement.
CONCLUSIONS: Therapists should be cognisant of factors that may impact on children's engagement in home-based computer programs and devise individual strategies with families to support sustained engagement.
DOI: 10.3109/01942638.2015.1076560
PMID: 26606419 [PubMed - indexed for MEDLINE]

Wii-ased interactive video games as a supplement to conventional therapy for rehabilitation of children with cerebral palsy: A pilot, randomized controlled trial.

Sajan JE, John JA, Grace P, Sabu SS, Tharion G

Dev Neurorehabil. 2016 Nov 15:1-7. [Epub ahead of print]

OBJECTIVE: To assess the effect of interactive video gaming (IVG) with Nintendo Wii (Wii) supplemented to conventional therapy in rehabilitation of children with cerebral palsy (CP).
DESIGN: Randomized, controlled, assessor-blinded study.
PARTICIPANTS: Children with CP; 10 children each in the control and intervention groups.
INTERVENTION: IVG using Wii, given as a supplement to conventional therapy, for 45 min per day, 6 days a week for 3 weeks. The children in the control group received conventional therapy alone.
OUTCOME MEASURES: Posture control and balance, upper limb function, visual-perceptual skills, and functional mobility.
RESULTS: Significant improvement in upper limb functions was seen in the intervention group but not in the control group. Improvements in balance, visual perception, and functional mobility were not significantly different between control and intervention groups.

CONCLUSIONS: Wii-based IVG may be offered as an effective supplement to conventional therapy in the rehabilitation of children with CP.
DOI: 10.1080/17518423.2016.1252970
PMID: 27846366 [PubMed - as supplied by publisher]

Thérapies cellulaires

In the Know and in the News: How Science and the Media Communicate About Stem Cells, Autism and Cerebral Palsy.
Sharpe K, Di Pietro N, Illes J
Stem Cell Rev. 2016 Feb;12(1):1-7. doi: 10.1007/s12015-015-9627-3.

Stem cell research has generated considerable attention for its potential to remediate many disorders of the central nervous system including neurodevelopmental disorders such as autism spectrum disorder (ASD) and cerebral palsy (CP) that place a high burden on individual children, families and society. Here we characterized messaging about the use of stem cells for ASD and CP in news media articles and concurrent dissemination of discoveries through conventional science discourse. We searched LexisNexis and Canadian Newsstand for news articles from the US, UK, Canada and Australia in the period between 2000 and 2014, and PubMed for peer reviewed articles for the same 10 years. Using in-depth content analysis methods, we found less cautionary messaging about stem cells for ASD and CP in the resulting sample of 73 media articles than in the sample of 87 science papers, and a privileging of benefits over risk. News media also present stem cells as ready for clinical application to treat these neurodevelopmental disorders, even while the science literature calls for further research. Investigative news reports that explicitly quote researchers, however, provide the most accurate information to actual science news. The hope, hype, and promise of stem cell interventions for neurodevelopmental disorders, combined with the extreme vulnerability of these children and their families, creates a perfect storm in which journalists and stem cell scientists must commit to a continued, if not even more robust, partnership to promote balanced and accurate messaging.
DOI: 10.1007/s12015-015-9627-3
PMID: 26454430 [PubMed - indexed for MEDLINE]

Autres

Application of a tri-axial accelerometry-based portable motion recorder for the quantitative assessment of hippotherapy in children and adolescents with cerebral palsy.
Mutoh T, Mutoh T, Takada M, Doumura M, Ihara M, Taki Y, Tsubone H, Ihara M
J Phys Ther Sci. 2016 Oct;28(10):2970-2974. Epub 2016 Oct 28.

[Purpose] This case series aims to evaluate the effects of hippotherapy on gait and balance ability of children and adolescents with cerebral palsy using quantitative parameters for physical activity.
[Subjects and Methods] Three patients with gait disability as a sequela of cerebral palsy (one female and two males; age 5, 12, and 25 years old) were recruited. Participants received hippotherapy for 30 min once a week for 2 years. Gait parameters (step rate, step length, gait speed, mean acceleration, and horizontal/vertical displacement ratio) were measured using a portable motion recorder equipped with a tri-axial accelerometer attached to the waist before and after a 10-m walking test.
[Results] There was a significant increase in step length between before and after a single hippotherapy session. Over the course of 2 year intervention, there was a significant increase in step rate, gait speed, step length, and mean acceleration and a significant improvement in horizontal/vertical displacement ratio.
[Conclusion] The data suggest that quantitative parameters derived from a portable motion recorder can track both immediate and long-term changes in the walking ability of children and adolescents with cerebral palsy undergoing hippotherapy.
Free PMC Article
DOI: 10.1589/jpts.28.2970
PMCID: PMC5088162
PMID: 27821971 [PubMed - in process]

Influence of neurophysiological hippotherapy on the transference of the centre of gravity among children with cerebral palsy.
Maćków A, Małachowska-Sobieska M, Demczuk-Włodarczyk E, Sidorowska M, Szklarska A, Lipowicz A
Ortop Traumatol Rehabil. 2014 Nov-Dec;16(6):581-93. doi: 10.5604/15093492.1135048.

BACKGROUND: The aim of the study was to present the influence of neurophysiological hippotherapy on the transference of the centre of gravity (COG) among children with cerebral palsy (CP).
MATERIAL AND METHODS: The study involved 19 children aged 4-13 years suffering from CP who demonstrated an asymmetric (A/P) model of compensation. Body balance was studied with the Cosmogamma Balance Platform. An examination on this platform was performed before and after a session of neurophysiological hippotherapy. In order to compare the correlations and differences between the examinations, the results were analysed using Student's T-test for dependent samples at $p \leq 0.05$ as the level of statistical significance and descriptive statistics were calculated.
RESULTS: The mean value of the body's centre of gravity in the frontal plane (COG X) was 18.33 (mm) during the first examination, changing by 21.84 (mm) after neurophysiological hippotherapy towards deloading of the antigravity lower limb ($p \leq 0.0001$). The other stabilographic parameters increased; however, only the change in average speed of antero - posterior COG oscillation was statistically significant ($p = 0.0354$).
CONCLUSION: 1. One session of neurophysiological hippotherapy induced statistically significant changes in the position of the centre of gravity in the body in the frontal plane and the average speed of COG oscillation in the sagittal plane among CP children demonstrating an asymmetric model of compensation (A/P).
DOI: 10.5604/15093492.1135048
PMID: 25694373 [PubMed - indexed for MEDLINE]

The Case for Musical Instrument Training in Cerebral Palsy for Neurorehabilitation.
Alves-Pinto A, Turova V, Blumenstein T, Lampe R
Neural Plast. 2016;2016:1072301. Epub 2016 Oct 27.

Recent imaging studies in cerebral palsy (CP) have described several brain structural changes, functional alterations, and neuroplastic processes that take place after brain injury during early development. These changes affect motor pathways as well as sensorimotor networks. Several of these changes correlate with behavioral measures of motor and sensory disability. It is now widely acknowledged that management of sensory deficits is relevant for rehabilitation in CP. Playing a musical instrument demands the coordination of hand movements with integrated auditory, visual, and tactile feedback, in a process that recruits multiple brain regions. These multiple demands during instrument playing, together with the entertaining character of music, have led to the development and investigation of music-supported therapies, especially for rehabilitation with motor disorders resulting from brain damage. We review scientific evidence that supports the use of musical instrument playing for rehabilitation in CP. We propose that active musical instrument playing may be an efficient means for triggering neuroplastic processes necessary for the development of sensorimotor skills in patients with early brain damage. We encourage experimental research on neuroplasticity and on its impact on the physical and personal development of individuals with CP.
Free PMC Article
DOI: 10.1155/2016/1072301
PMID: 27867664 [PubMed - in process]

Langage – Communication

CA²JU: an Assistive Tool for Children with Cerebral Palsy.
Santos FA, Júnior CA, Teixeira Macedo H, Chella MT, do Nascimento Givigi RC, Barbosa L
Stud Health Technol Inform. 2015;216:589-93.

This paper presents CA2JU, a hardware/software tool that aims to help individuals with severe speech or language problems in their communication in order to promote their social and digital inclusion. CA2JU is composed of two

applications: CA2JU Accelerated, which makes typing faster by suggesting potential words to the user; and CA2JU Illustrated, which automatically converts a sentence of words into a sequence of pictographic symbols, allowing a user familiar with the symbols to verify whether the written sentence is correct. We have implemented, evaluated in a controlled scenario, and deployed CA2JU in a real environment with children with cerebral palsy. In the controlled settings, the results confirm CA2JU Accelerated speed up typing by reducing the number of clicks made by users, and CA2JU Illustrated obtained high accuracy by suggesting the correct pictograms from sentences. In the real scenario, the two use cases show that the children improved their communication and linguistic abilities.
PMID: 26262119 [PubMed - indexed for MEDLINE]

Familiarization effects on word intelligibility in dysarthric speech.
Folia Phoniatr Logop. 2014;66(6):258-64. doi: 10.1159/000369799. Epub 2015 Feb 7.
Kim H, Nanney S.

BACKGROUND/AIMS: This study investigated the effects of familiarization on naïve listeners' ability to perceive dysarthric speech produced by speakers with cerebral palsy and evaluated the degree of intelligibility improvement, both in the short and long term, as a function of (1) familiarization paradigms and (2) the number of familiarization phases.
METHODS: A total of 120 listeners (30 listeners/speaker) were recruited to complete word transcription tasks over a 6-week period. The listeners were assigned to one of the following familiarization paradigms: passive familiarization with audio signal only, active familiarization with both audio and orthography, and no explicit familiarization. Intelligibility scores were measured as the percentage of words correctly transcribed.
RESULTS: The active familiarization paradigm that provided listeners with both audio and orthography resulted in higher intelligibility scores compared to the passive familiarization and no explicit familiarization conditions. The degree of intelligibility improvement as a function of passive familiarization varied depending on the speaker. Last, the advantage of active familiarization was also found as a long-term effect.
CONCLUSION: Our findings provide evidence for the benefits of familiarization in enhancing the intelligibility of dysarthric speech and support the efficacy of familiarization paradigms as an intervention technique in the management of dysarthria.

Free PMC Article
DOI: 10.1159/000369799
PMCID: PMC4341980
PMID: 25676630 [PubMed - indexed for MEDLINE]

Longitudinal development of communication in children with cerebral palsy between 24 and 53 months: Predicting speech outcomes.
Hustad KC, Allison KM, Sakash A, McFadd E, Broman AT, Rathouz PJ
Dev Neurorehabil. 2016 Oct 28:1-8. [Epub ahead of print]

OBJECTIVE: To determine whether communication at 2 years predicted communication at 4 years in children with cerebral palsy (CP); and whether the age a child first produces words imitatively predicts change in speech production.
METHOD: 30 children (15 males) with CP participated and were seen 5 times at 6-month intervals between 24 and 53 months (mean age at time 1 = 26.9 months (SD 1.9)). Variables were communication classification at 24 and 53 months, age that children were first able to produce words imitatively, single-word intelligibility, and longest utterance produced.
RESULTS: Communication at 24 months was highly predictive of abilities at 53 months. Speaking earlier led to faster gains in intelligibility and length of utterance and better outcomes at 53 months than speaking later.
CONCLUSION: Inability to speak at 24 months indicates greater speech and language difficulty at 53 months and a strong need for early communication intervention.
DOI: 10.1080/17518423.2016.1239135
PMID: 27792399 [PubMed - as supplied by publisher]

Predicting speech intelligibility with a multiple speech subsystems approach in children with cerebral palsy.

Lee J, Hustad KC, Weismer G.
J Speech Lang Hear Res. 2014 Oct;57(5):1666-78. doi: 10.1044/2014_JSLHR-S-13-0292.

PURPOSE: Speech acoustic characteristics of children with cerebral palsy (CP) were examined with a multiple speech subsystems approach; speech intelligibility was evaluated using a prediction model in which acoustic measures were selected to represent three speech subsystems.
METHOD: Nine acoustic variables reflecting different subsystems, and speech intelligibility, were measured in 22 children with CP. These children included 13 with a clinical diagnosis of dysarthria (speech motor impairment [SMI] group) and 9 judged to be free of dysarthria (no SMI [NSMI] group). Data from children with CP were compared to data from age-matched typically developing children.
RESULTS: Multiple acoustic variables reflecting the articulatory subsystem were different in the SMI group, compared to the NSMI and typically developing groups. A significant speech intelligibility prediction model was obtained with all variables entered into the model (adjusted R2 = .801). The articulatory subsystem showed the most substantial independent contribution (58%) to speech intelligibility. Incremental R2 analyses revealed that any single variable explained less than 9% of speech intelligibility variability.
CONCLUSIONS: Children in the SMI group had articulatory subsystem problems as indexed by acoustic measures. As in the adult literature, the articulatory subsystem makes the primary contribution to speech intelligibility variance in dysarthria, with minimal or no contribution from other systems.
Free PMC Article
DOI: 10.1044/2014_JSLHR-S-13-0292
PMCID: PMC4192090
PMID: 24824584 [PubMed - indexed for MEDLINE]

Prevalence of people who could benefit from augmentative and alternative communication (AAC) in the UK: determining the need.
Creer S, Enderby P, Judge S, John A
Int J Lang Commun Disord. 2016 Nov;51(6):639-653. doi: 10.1111/1460-6984.12235. Epub 2016 Apr 26.

BACKGROUND: Commissioners and providers require information relating to the number of people requiring a service in order to ensure provision is appropriate and equitable for the population they serve. There is little epidemiological evidence available regarding the prevalence of people who could benefit from augmentative and alternative communication (AAC) in the UK.
AIM: To determine the prevalence of people who could benefit from AAC in the UK.
METHODS & PROCEDURES: An epidemiological approach was taken to create a new estimate of need: the prevalence of the main medical conditions and specific symptoms leading to the requirement for AAC were identified from the literature and AAC specialists were consulted to estimate the number of people who may require AAC. OUTCOMES & RESULTS: A total of 97.8% of the total number of people who could benefit from AAC have nine medical conditions: dementia, Parkinson's disease, autism, learning disability, stroke, cerebral palsy, head injury, multiple sclerosis and motor neurone disease. The total expectation is that 536 people per 100 000 of the UK population (approximately 0.5%) could benefit from AAC.
CONCLUSIONS & IMPLICATIONS: To provide accurate figures on the potential need for and use of AAC, data need to be consistently and accurately recorded and regularly reviewed at a community level. The existing data suggest an urgent need for more accurate and up to date information to be captured about the need for AAC in the UK to provide better services and ensure access to AAC strategies, equipment and support.

DOI: 10.1111/1460-6984.12235
PMID: 27113569 [PubMed - in process]

"Social Media has Opened a World of 'Open communication:'" experiences of Adults with Cerebral Palsy who use Augmentative and Alternative Communication and Social Media.
Caron J, Light J
Augment Altern Commun. 2016;32(1):25-40. doi: 10.3109/07434618.2015.1052887. Epub 2015 Jun 9.

An online focus group was used to investigate the experiences of nine individuals with cerebral palsy who use augmentative and alternative communication (AAC) and social media. Information was gathered related to (a) advantages of social media, (b) disadvantages of social media, (c) barriers to successful use, (d) supports to successful use, and (e) recommendations for other individuals using AAC, support personnel, policy makers, and technology developers. Participants primarily chose to focus on social media as a beneficial tool and viewed it as an important form of communication. The participants did describe barriers to social media use (e.g., technology). Despite barriers, all the participants in this study took an active role in learning to use social media. The results are discussed as they relate to themes and with reference to published literature.
DOI: 10.3109/07434618.2015.1052887
PMID: 26056722 [PubMed - indexed for MEDLINE]

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]

AIM: 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.
METHOD: 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.
RESULTS: 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.
INTERPRETATION: 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.

DOI: 10.1111/dmcn.13342
PMID: 27897320 [PubMed - as supplied by publisher]

Variability and Diagnostic Accuracy of Speech Intelligibility Scores in Children.
Hustad KC, Oakes A, Allison K.
J Speech Lang Hear Res. 2015 Dec;58(6):1695-707. doi: 10.1044/2015_JSLHR-S-14-0365.

PURPOSE: We examined variability of speech intelligibility scores and how well intelligibility scores predicted group membership among 5-year-old children with speech motor impairment (SMI) secondary to cerebral palsy and an age-matched group of typically developing (TD) children.
METHOD: Speech samples varying in length from 1-4 words were elicited from 24 children with cerebral palsy (mean age 60.50 months) and 20 TD children (mean age 60.33 months). Two hundred twenty adult listeners made orthographic transcriptions of speech samples (n = 5 per child).
RESULTS: Variability associated with listeners made a significant contribution to explaining the variance in intelligibility scores for TD and SMI children, but the magnitude was greater for TD children. Intelligibility scores differentiated very well between children who have SMI and TD children when intelligibility was at or below approximately 75% and above approximately 85%.
CONCLUSIONS: Intelligibility seems to be a useful clinical tool for differentiating between TD children and children with SMI at 5 years of age; however, there is considerable variability within and between listeners, highlighting the need for more than one listener per child to ensure validity of an intelligibility measure.
Free PMC Article
DOI: 10.1044/2015_JSLHR-S-14-0365
PMCID: PMC4987026
PMID: 26381119 [PubMed - indexed for MEDLINE]

A rectally administered combination of midazolam and ketamine was easy, effective and feasible for procedural pain in children with cerebral palsy.
Nilsson S, Brunsson I, Askljung B, Påhlman M, Himmelmann K
Acta Paediatr. 2016 Dec 19. doi: 10.1111/apa.13710. [Epub ahead of print]

AIM: The aim of this study was to investigate how effective a combination of rectally administered midazolam and racemic ketamine was for reducing pain in paediatric cerebral palsy patients receiving intramuscular injections of botulinum neurotoxin A. The feasibility and safety of the pain relief were also explored.
METHOD: Children with cerebral palsy, aged 1-18 years, were recruited from a regional paediatric rehabilitation unit between April 2012 and May 2014. Pain intensity, feasibility, total time spent in the clinic and side effects wereregistered. Pain scores were recorded by parents and healthcare professionals using different pain scales.
RESULTS: We recorded 128 procedures in 61 children. The median scores were two (range 0-10) for pain intensity and nine (range 0-10) for feasibility. The median treatment time in the outpatient unit was 3.25 hours and the most common side effects were nausea, pain and sleep disturbance. Gross motor function levels showed a negative correlation with the pain scores. This method could be an alternative to nitrous oxide/oxygen mixture for patients who do not tolerate inhalation analgesia.
CONCLUSION: Rectally administered midazolam and racemic ketamine provided effective pain relief for paediatric cerebral palsy outpatients receiving painful injections and was a viable alternative to inhalation analgesia. This article is

DOI: 10.1111/apa.13710
PMID: 27992073 [PubMed - as supplied by publisher]

Change in pain status in children with cerebral palsy.
Christensen R, Macintosh A, Switzer L, Fehlings D
Dev Med Child Neurol. 2016 Nov 15. doi: 10.1111/dmcn.13328. [Epub ahead of print]

AIM: To identify factors associated with a change in pain over time in children with cerebral palsy (CP).
METHOD: Pain was assessed at two time-points by physicians and caregiver-rated Health Utilities Index 3 (HUI3) pain scores.
RESULTS: One hundred and forty-eight children out of 179 approached from outpatient clinics (83% response; 104 males, 44 females mean age 8y 8mo, range 3y-16y) across all Gross Motor Function Classification System (GMFCS) levels were included. Fifty-five percent had changes in caregiver-reported HUI3 pain. A backward stepwise multiple linear regression retained HUI3 pain score at visit 1 and GMFCS level ($F[2,144] = 23.40$, $R(2) = 0.35$; $p<0.001$) as variables associated with a change in pain status (HUI3 pain at visit 1: $\beta=0.61$, $p<0.001$; GMFCS level: $\beta=-0.17$, $p<0.015$). The association between HUI3 pain at visit 1 and GMFCS level was significant ($\beta=-0.15$, $p<0.036$). There was an association between pain etiology and pain trajectory ($F[3,144] = 5.39$, $p=0.002$). Post-hoc testing revealed musculoskeletal pain had the greatest improvements compared with the no pain group ($p=0.006$).
INTERPRETATION: Children with CP with more severe initial pain and higher gross motor function have lower pain at follow-up indicating an improvement in pain status over time.

DOI: 10.1111/dmcn.13328
PMID: 27861779 [PubMed - as supplied by publisher]

Hip pain is more frequent in severe hip displacement: a population-based study of 77 children with cerebral palsy.
Ramstad K, Terjesen T.
J Pediatr Orthop B. 2016 May;25(3):217-21. doi: 10.1097/BPB.0000000000000282.

The aim of this study was to assess whether hip pain was associated with radiographic hip displacement (migration percentage, MP) in a population-based cohort of children with cerebral palsy. Seventy-seven children, mean age 9.5 (SD 1.6) years and Gross Motor Function Classification System level III-V, were assessed. Caregivers responded to

the Child Health Questionnaire pain questions and located recurrent pain on a body map. Hip pain was reported in 22 children (29%) and 27 hips (18%). Hip pain was significantly more frequent in hips with MP more than or equal to 50%, in children with spastic quadriplegia, and in those with Gross Motor Function Classification System level V. We conclude that severe hip displacement with MP more than or equal to 50% was associated with hip pain, whereas slight or moderate subluxation did not influence the occurrence of such pain.
DOI: 10.1097/BPB.0000000000000282
PMID: 26895291 [PubMed - indexed for MEDLINE]

Pain report and musculoskeletal impairment in young people with severe forms of cerebral palsy: A population-based series.
McDowell BC, Duffy C, Lundy C
Res Dev Disabil. 2016 Oct 25. pii: S0891-4222(16)30226-8. doi: 10.1016/j.ridd.2016.10.006. [Epub ahead of print]

BACKGROUND: While pain is reportedly more prevalent in more functionally impaired children with cerebral palsy, information is scant in those with poor communication skills.
METHODS: Young people (4-27 years) with severe forms of cerebral palsy were recruited from a population-based register. The Child Health Questionnaire (CHQ) provided information on general health and bodily pain; the Paediatric Pain Profile (PPP) was used for participants with limited communication; and the Spinal Alignment and Range of Motion Measure (SAROMM) described musculoskeletal impairment.
RESULTS: 123 young people (GMFCS IV=55 and V=68) and their families/carers participated. Fourteen percent of CHQ responses (n=123) reported severe/very severe pain in recent weeks, whilst 7% reported pain every/almost every day. CHQ pain report was significantly higher for young people in GMFCS level V and correlated significantly with both global health and musculoskeletal impairment. High levels of pain were recorded on the PPP for non-communicating children but only a weak correlation between PPP and CHQ scores was detected.
CONCLUSION: Managing pain in young people with severe musculoskeletal and cognitive impairment presents a huge challenge to carers and professionals. The PPP may represent a useful adjunct in those young people with severe communication difficulties.

DOI: 10.1016/j.ridd.2016.10.006
PMID: 27793550 [PubMed - as supplied by publisher]

Validity of the Child Facial Coding System for the Assessment of Acute Pain in Children With Cerebral Palsy.
Hadden KL, LeFort S, O'Brien M, Coyte PC, Guerriere DN
J Child Neurol. 2016 Apr;31(5):597-602. doi: 10.1177/0883073815604228. Epub 2015 Sep 9.

The purpose of the current study was to examine the concurrent and discriminant validity of the Child Facial Coding System for children with cerebral palsy. Eighty-five children (mean = 8.35 years, SD = 4.72 years) were videotaped during a passive joint stretch with their physiotherapist and during 3 time segments: baseline, passive joint stretch, and recovery. Children's pain responses were rated from videotape using the Numerical Rating Scale and Child Facial Coding System. Results indicated that Child Facial Coding System scores during the passive joint stretch significantly correlated with Numerical Rating Scale scores ($r = .72$, $P < .01$). Child Facial Coding System scores were also significantly higher during the passive joint stretch than the baseline and recovery segments ($P < .001$). Facial activity was not significantly correlated with the developmental measures. These findings suggest that the Child Facial Coding Sytem is a valid method of identifying pain in children with cerebral palsy.

DOI: 10.1177/0883073815604228
PMID: 26353879 [PubMed - indexed for MEDLINE]

Autres Troubles / Troubles concomitants

Troubles respiratoires

Association Between Chronic Aspiration and Chronic Airway Infection with Pseudomonas aeruginosa and Other Gram-Negative Bacteria in Children with Cerebral Palsy.

Gerdung CA, Tsang A, Yasseen AS 3rd, Armstrong K, McMillan HJ, Kovesi T

Lung. 2016 Apr;194(2):307-14. doi: 10.1007/s00408-016-9856-5. Epub 2016 Feb 16.

PURPOSE: Children with cerebral palsy (CP) are at an increased risk for aspiration, and subsequent pneumonia or pneumonitis. Pneumonia is a common cause of hospital admission, intensive care unit (ICU) admission, and death in patients with CP, and may disproportionately contribute to mortality. The role of respiratory microflora is unknown. This study examined the relationship between respiratory infections with Gram-negative bacteria (GNB), particularly Pseudomonas aeruginosa, and the frequency/severity of pneumonia hospitalization.

METHODS: Retrospective chart review of 69 patients with CP and hospitalization for pneumonia. Eligible patients required hospitalization for bacterial pneumonia, at least one respiratory culture, and fulfillment of Bax definition of CP. Group assignment was based on respiratory culture. Charts were analyzed for comorbid illness, hospitalization demographics, and disease severity.

RESULTS: Children with isolation of P. aeruginosa or other GNB had increased frequency of ICU admission (77.4, 65.1, vs. 26.9 %, respectively, $p < 0.01$), intubation (45.2, 39.5 vs. 11.5 %, $p = 0.02$, $p = 0.03$ respectively), and large pleural effusions (37.5, vs. 0 %) than children without GNB. Children with isolation of GNB had more prolonged hospitalizations and were more likely to have multiple hospitalizations than those without GNB.

CONCLUSION: Colonization with P. aeruginosa and other Gram-negative organisms in children with CP is associated with increased morbidity, prolonged hospitalization, and severity of pneumonia including need for PICU admission and intervention. Further research is required to determine causality, the role of antimicrobials active against Gram negative in pneumonia treatment, and the role of GNB eradication therapy in children with CP.

DOI: 10.1007/s00408-016-9856-5
PMID: 26883134 [PubMed - indexed for MEDLINE]

Troubles musculosquelettiques, des tissusconjonctifs et osseux

Cortical bone deficit and fat infiltration of bone marrow and skeletal muscle in ambulatory children with mild spastic cerebral palsy.

Whitney DG, Singh H, Miller F, Barbe MF, Slade JM, Pohlig RT, Modlesky CM

Bone. 2017 Jan;94:90-97. doi: 10.1016/j.bone.2016.10.005. Epub 2016 Oct 11.

INTRODUCTION: Nonambulatory children with severe cerebral palsy (CP) have underdeveloped bone architecture, low bone strength and a high degree of fat infiltration in the lower extremity musculature. The present study aims to determine if such a profile exists in ambulatory children with mild CP and if excess fat infiltration extends into the bone marrow.

MATERIALS AND METHODS: Ambulatory children with mild spastic CP and typically developing children (4 to 11years; 12/group) were compared. Magnetic resonance imaging was used to estimate cortical bone, bone marrow and total bone volume and width, bone strength [i.e., section modulus (Z) and polar moment of inertia (J)], and bone marrow fat concentration in the midtibia, and muscle volume, intermuscular, subfascial, and subcutaneous adipose tissue (AT) volume and intramuscular fat concentration in the midleg. Accelerometer-based activity monitors worn on the ankle were used to assess physical activity.

RESULTS: There were no group differences in age, height, body mass, body mass percentile, BMI, BMI percentile or tibia length, but children with CP had lower height percentile (19th vs. 50th percentile) and total physical activity counts (44%) than controls (both $p<0.05$). Children with CP also had lower cortical bone volume (30%), cortical bone width in the posterior (16%) and medial (32%) portions of the shaft, total bone width in the medial-lateral direction (15%), Z in the medial-lateral direction (34%), J (39%) and muscle volume (39%), and higher bone marrow fat concentration (82.1±1.8% vs. 80.5±1.9%), subfascial AT volume (3.3 fold) and intramuscular fat concentration (25.0±8.0% vs. 16.1±3.3%) than controls (all $p<0.05$). When tibia length was statistically controlled, all group differences in bone architecture, bone strength, muscle volume and fat infiltration estimates, except posterior cortical bone width, were still present (all $p<0.05$). Furthermore, a higher intermuscular AT volume in children with CP compared to controls emerged ($p<0.05$).

CONCLUSIONS: Ambulatory children with mild spastic CP exhibit an underdeveloped bone architecture and low bone strength in the midtibia and a greater infiltration of fat in the bone marrow and surrounding musculature compared

to typically developing children. Whether the deficit in the musculoskeletal system of children with CP is associated with higher chronic disease risk and whether the deficit can be mitigated requires further investigation.

DOI: 10.1016/j.bone.2016.10.005
PMID: 27732905 [PubMed - in process]

Osteoporosis in adults with cerebral palsy: feasibility of DXA screening and risk factors for low bone density.
Marciniak C, Gabet J, Lee J, Ma M, Brander K, Wysocki N
Osteoporos Int. 2016 Apr;27(4):1477-84. doi: 10.1007/s00198-015-3393-6. Epub 2015 Nov 17.

This study aims to describe osteoporosis screening in adults with cerebral palsy (CP) and identify any associated factors. Bone mineral density (BMD) was often lower than expected-for-age in these adults, and present even in young adulthood, particularly at the spine. Low BMD is frequent in adults with CP
.INTRODUCTION: This study aims to describe the feasibility of dual-energy X-Ray absorptiometry (DXA) screening in adults with cerebral palsy (CP) and identify factors associated with low bone mineral density (BMD), including longitudinal changes.
METHODS: A retrospective chart review study of these adults seen at an urban academic rehabilitation clinic and who underwent DXA scan(s). BMD and Z-scores for the lumbar spine, hips, and femoral (neck and total) were recorded. The change in BMD and Z-scores from baseline to follow-up DEXA, Gross Motor Functional Classification System (GMFCS), CP pattern (hemiplegic, diplegic, or quadriplegic), body mass index (BMI), and transfer and ambulation status were assessed.
RESULTS: Forty-two patients (83 % less than age 50 years) had at least one DXA. Seventeen had at least two studies, 15 without pharmacologic interventions between studies. Thirteen fractures in eight subjects were noted, most often lower limb. Fifty percent of spine studies in individuals under 50 had a Z-score of less than -2, while 25 and 30.8 % of these individuals had such scores at the right and left total hip sites, respectively. Need for transfer assistance was associated with lower BMD and Z-scores at all hip sites, but not the lumbar spine. Progressive abnormalities were seen at follow-up DXAs at some sites, however these were not statistically significant.
CONCLUSIONS: Lower than expected-for-age BMD was very frequent in adults with CP with mobility limitations, present at both spine and hip sites. Low BMI and need for transfer assistance had a negative impact on BMD. Although not statistically significant, progression of abnormalities was seen at follow-up for DXAs Z-scores at some sites, which suggests longitudinal studies in this population are needed.
DOI: 10.1007/s00198-015-3393-6
PMID: 26576540 [PubMed - indexed for MEDLINE]

Troubles digestifs

Gastroesophageal Reflux in Neurologically Impaired Children: What Are the Risk Factors?
Kim S, Koh H, Lee JS
Gut Liver. 2016 Nov 14. doi: 10.5009/gnl16150. [Epub ahead of print]

Background/Aims: Neurologically impaired patients frequently suffer from gastrointestinal tract problems, such as gastroesophageal reflux disease (GERD). In this study, we aimed to define the risk factors for GERD in neurologically impaired children.
Methods: From May 2006 to March 2014, 101 neurologically impaired children who received 24-hour esophageal pH monitoring at Severance Children's Hospital were enrolled in the study. The esophageal pH finding and the clinical characteristics of the patients were analyzed.
Results: The reflux index was higher in patients with abnormal electroencephalography (EEG) results than in those with normal EEG results (p=0.027). Mitochondrial disease was associated with a higher reflux index than were pileptic disorders or cerebral palsy (p=0.009). Patient gender, feeding method, scoliosis, tracheostomy, and baclofen use did not lead to statistical differences in reflux index. Age of onset of neurological impairment was inversely correlated with DeMeester score and reflux index. Age at the time of examination, the duration of the disease, and the number of antiepileptic drugs were not correlated with GER severity.
Conclusions: Early-onset neurological impairment, abnormal EEG results, and mitochondrial disease are risk factors for severe GERD.

Free Article
DOI: 10.5009/gnl16150
PMID: 27840365 [PubMed - as supplied by publisher]

The effects of connective tissue manipulation and Kinesio Taping on chronic constipation in children with cerebral palsy: a randomized controlled trial.
Orhan C, Kaya Kara O, Kaya S, Akbayrak T, Kerem Gunel M, Baltaci G
Disabil Rehabil. 2016 Oct 28:1-11. [Epub ahead of print]

PURPOSE: The aim of this study was to investigate the effects of connective tissue manipulation (CTM) and Kinesio Taping(®) (KT) on constipation and quality of life in children with cerebral palsy (CP).
METHOD: This study was designed as a randomized controlled trial. Forty children diagnosed with chronic constipation based on Rome III criteria were randomly assigned to CTM group [6 females, 7 males; 8 y 6 mo (SD = 3y 4 mo)], KT group [7 female, 7 male; 8y 7 mo (SD =3y 5 mo)] or control group [6 female, 7 male; 8y 3 mo (SD = 3y 6 mo)]. All patients were assessed with 7-day bowel diaries, Bristol Stool Form Scale (BSFS), Visual Analog Scale (VAS), and Pediatric Quality of Life Inventory (PEDsQL). Kruskal-Wallis, Wilcoxon's signed-rank, and Mann-Whitney U tests were used to determine intra-group and inter-group differences. The level of significance was $p < 0.05$.
RESULTS: Among the CTM, KT, and control groups, there were statistically significant differences regarding the changes in defecation frequency (2.46, 3.00, 0.30, ES 1.16, $p < 0.001$), duration of defecation (5.07, 5.35, 0.15, ES 2.37, $p = 0.003$), BSFS (1.84, 2.14, 0.07, ES 0.91, $p < 0.001$), VAS (4.83, 3.87, 0.23, ES 1.98, $p < 0.001$), and PEDsQL total scores (7, 14, 8.36, -0.85, ES 4.08, $p < 0.001$).
CONCLUSIONS: This study revealed that CTM and KT seem equally effective physiotherapy approaches for the treatment of pediatric constipation and these approaches may be added to bowel rehabilitation program. Implications for rehabilitation CTM and KT have similar effectiveness in alleviating the constipation-related symptoms and improving quality of life in children with CP. CTM and KT can be integrated into bowel rehabilitation programs. Considering the characteristics of patients, these treatment options can be used as an alternative of each other by physiotherapists.
DOI: 10.1080/09638288.2016.1236412
PMID: 27793072 [PubMed - as supplied by publisher]

Nutrition – Troubles nutritionnels

Cerebral Palsy in Children as a Risk Factor for Malnutrition.
Perenc L, Przysada G, Trzeciak J.
Ann Nutr Metab. 2015;66(4):224-32. doi: 10.1159/000431330. Epub 2015 Jun 19.

AIM: The main aim of this study was to determine some malnutrition risk factors among children with cerebral palsy (CP). Children with CP often require the assistance of physical therapy centers. Experience suggests that, apart from physical disabilities, this group often suffers from malnutrition.
METHODS: Data were gathered in the hospital among 128 children aged 3-18 years who were suffering from CP. The children were admitted from 2011 to 2013 to the Center for Neurological Physical Therapy for children in the Regional Hospital No. 2. St. Queen Jadwiga in Rzeszow (RORE). Statistical analyses were conducted for data on gender, age, type of CP, motor function level according to Gross Motor Function Classification Scale (GMFCS), body mass index (BMI) and hemoglobin levels in blood.
RESULTS: The risk of anemia differs based on gender--the risk is 6 times greater among boys than among girls ($p = 0.0398$). Risk of malnutrition is 3.5 times higher in children with tetraplegia than in children with diplegia or hemiplegia ($p = 0.0043$). Higher GMFCS scores are connected to greater proportions of malnourished children (for BMI z-score <-1.64, $p = 0.0010$).
CONCLUSIONS: Among children with CP, malnourishment risk factors are male gender for anemia and tetraplegia and high GMFCS values.

DOI: 10.1159/000431330
PMID: 26111638 [PubMed - indexed for MEDLINE]

Comparison of micronutrient levels in children with cerebral palsy and neurologically normal controls.
Kalra S, Aggarwal A, Chillar N, Faridi MM.
Indian J Pediatr. 2015 Feb;82(2):140-4. doi: 10.1007/s12098-014-1543-z. Epub 2014 Aug 9.

OBJECTIVE: To measure levels of micronutrients in children with cerebral palsy and compare them with neurologically normal children of similar nutritional status.
METHODS: Fifty children with cerebral palsy (2-12 y) and 50 age and sex matched controls of similar nutritional status were enrolled. Detailed dietary history was recorded and nutritional status assessed. Venous blood (3 ml) was drawn for analysis. Micronutrient levels were measured as per standard technique.
RESULTS: Serum iron was 12.6 ± 5.9 and 20.9 ± 3.3 µmol/L in CP and controls respectively (P < 0.001). Mean copper levels were 106.2 ± 38.3 µg/dl in CP and 128.8 ± 20.2 µg/dl in controls (P < 0.001); magnesium levels were 1.97 ± 0.4 and 2.2 ± 0.3 mg/dl (P = 0.003). Zinc levels were similar in CP and controls (P = 0.979). The mean energy intake was significantly less in CP (P = 0.016). Mean protein intake did not vary significantly (P = 0.847). No correlation was found between energy intake and serum levels of micronutrients (P > 0.05). There was no difference in micronutrient levels with respect to gross motor functional classification system (GMFCS) grades and limb involvement (P > 0.05).
CONCLUSIONS: The serum levels of iron, copper and magnesium are significantly less in children with cerebral palsy, hence the need for supplementation.
DOI: 10.1007/s12098-014-1543-z
PMID: 25106843 [PubMed - indexed for MEDLINE]

[Effect of supplementation with a single dose of vitamin D in children with cerebral palsy. Preliminary randomised controlled study].[Article in Spanish]
Le Roy C(1), Meier M(2), Witting S(3), Pérez-Bravo F(4), Solano C(5), Castillo-Durán C(6).
Rev Chil Pediatr. 2015 Nov-Dec;86(6):393-8. doi: 10.1016/j.rchipe.2015.07.015. Epub 2015 Oct 21.

INTRODUCTION: Children with cerebral palsy (CP) have an increased risk of vitamin D (VD) deficiency. Although there are many studies on VD and CP, there is limited information about VD supplementation in these patients.
OBJECTIVE: To evaluate the effect of supplementation with a single dose of VD on the plasma concentrations of 25-hydroxy-vitamin-D (25OHD) in children with CP.
PATIENTS AND METHOD: Prospective-randomised-controlled-trial, including 30 Chilean children (19 males) with CP, median age 9.9 years (6.2-13.5). Clinical and biochemical variables including 25OHD, were recorded (time 0 and 8 weeks). Patients were allocated to the supplemented (S) group receiving 100,000 IU oral D3 at baseline, and compared with the placebo (P) group.
RESULTS: Among clinical features are highlighted: gastrostomy (60%), underweight (30%), bed-ridden (93.3%), antiepileptic drugs (70%), and 43.3% used VD metabolism inducing antiepileptics. Baseline biochemical measurements were normal. The 25OHD was insufficient in 4/30 and deficient in 6/30. 25OHD levels were not associated with the variables studied. Eight patients completed the study in the S group, and 10 in P group. The placebo and supplementation groups had no significant difference in baseline variables. Serum calcium, phosphate, and alkaline phosphatase levels at 8 weeks were normal in both groups, with no statistically significant differences. 25OHD in the P group was normal in 6/10, and insufficient+deficient in 4/10, and the S group was normal in all (8/8) (exact Fisher test P=.07).
CONCLUSIONS: A single dose of 100,000 IU VD could normalise the concentrations of 25OHD after 8 weeks of supplementation in Children with CP, but more studies are required to confirm these results.
Free Article

DOI: 10.1016/j.rchipe.2015.07.015
PMID: 26471311 [PubMed - indexed for MEDLINE]

Energy expenditure in children with cerebral palsy and moderate / severe malnutrition during nutritional recovery.
García-Contreras AA, Vásquez-Garibay EM, Romero-Velarde E, Ibarra-Gutierrez AI, Troyo-Sanroman R
Nutr Hosp. 2015 May 1;31(5):2062-9. doi: 10.3305/nh.2015.31.5.8588.

OBJECTIVE: To analyze the total energy expenditure (TEE) and resting energy expenditure (REE) in children with cerebral palsy (CP) and moderate or severe malnutrition during nutritional recovery.
METHODS: In an intervention study, thirteen subjects with CP (10 females and 3 males with a mean age of 9y11m ± 2y3m), level V of the Gross Motor Function Classification System and moderate or severe malnutrition were included. Eight were fed by nasogastric tube and five by gastrostomy. They were compared with 57 healthy participants (31 females and 26 males with mean age of 8y7m ± 10m). Anthropometric measurements, body composition and energy expenditure by bioelectrical impedance analysis (BIA) and indirect calorimetry (IC) were performed in both groups.
RESULTS: TEE and REE were higher in healthy children than in children with CP in kcal/d and kcal/cm/d but were lower in kcal/kg/d ($p < 0.001$). Intensive nutritional support for four weeks in children with CP produced a significant increase in energy expenditure.
CONCLUSION: TEE and REE, in children with CP, are lower than in healthy children. Estimating the REE in children with CP and malnutrition is better performed in kcal/kg/d than in kcal/cm/d. Fat-free mass (FFM) is a good predictor of the REE in healthy children and children with CP.
Free Article
DOI: 10.3305/nh.2015.31.5.8588
PMID: 25929375 [PubMed - indexed for MEDLINE]

Sphère bucco-dentaire – Troubles de la déglutition

Assessment of traumatic dental injuries in patients with cerebral palsy.
Dubey A, Ghafoor PA, Rafeeq M.
J Indian Soc Pedod Prev Dent. 2015 Jan-Mar;33(1):25-7. doi: 10.4103/0970-4388.148969.

BACKGROUND: Cerebral palsy is an umbrella term for a group of conditions characterized essentially by motor dysfunctions that may be associated with sensory or cognitive impairment. Such children tend to have a higher incidence of traumatic dental injuries than the general population. This increased incidence is often attributed to poor muscular co-ordination that predisposes individuals with Cerebral palsy to trauma Aim: The study was conducted to assess different dental injuries and the risk factors for dental trauma to occur in patients with cerebral palsy.
MATERIALS AND METHODS: The study comprised 70 children and adolescents with cerebral palsy attending special school in Durg and Bhilai city between 7 and 18 years of age.
RESULTS: Dentinal fracture was seen in 40% of cases. Few cases had tooth displacement, discoloration, and pulpal involvement.
CONCLUSION: Dentists should be well aware of the possible dental injuries in such patients. Preventive measure measures should be taken by health care provider to reduce traumatic exposure.
Free Article
DOI: 10.4103/0970-4388.148969
PMID: 25572369 [PubMed - indexed for MEDLINE]

Bilateral transcervical submandibular gland excision for drooling: A study of themature scar and long-term effects.
Delsing CP, Viergever T, Honings J, van den Hoogen FJ
Eur J Paediatr Neurol. 2016 Sep;20(5):738-44. doi: 10.1016/j.ejpn.2016.05.001.Epub 2016 May 11.

AIM: Several surgical techniques are available to treat drooling in neurologically disabled children and adolescents, with bilateral submandibular gland excision being the only transcervical procedure. External scars can be a reason to decline for this surgical approach. We investigated which factors influenced caregiver satisfaction by evaluating the long-term scar in relation to treatment outcome.
METHODS: We identified a historical cohort, in which all neurologically disabled patients who underwent bilateral submandibular gland excision for drooling between January 2009 and December 2013 were identified (n = 41). The Patient and Observer Scar Assessment Scale (POSAS) was used to evaluate observer and clinician satisfaction. All included patients were contacted by telephone and completed a digital questionnaire that included digital images of the scars.

RESULTS: Of the caregivers that responded the questionnaire 76% (19/25) were satisfied with the overall outcome. Twenty-four (96%) caregivers considered the scars acceptable. Caregiver satisfaction was not correlated to the appearance of scars, but was significantly correlated with the decrease in drooling severity on a visual analogue scale ($p = 0.035$) and decrease in lower respiratory tract infections ($p = 0.042$).
INTERPRETATION: The appearance of scars does not influence satisfaction after bilateral submandibular gland excision for drooling. As expected, satisfaction is correlated to the treatment outcome.

DOI: 10.1016/j.ejpn.2016.05.001
PMID: 27245880 [PubMed - indexed for MEDLINE]

Both pharyngeal and esophageal phases of swallowing are associated with recurrent pneumonia in pediatric patients.

Serel Arslan S, Demir N, Karaduman AA
Clin Respir J. 2016 Dec 7. doi: 10.1111/crj.12592. [Epub ahead of print]

INTRODUCTION: One of the underlying causes of recurrent pneumonia in children is swallowing dysfunction, with aspiration syndrome. Swallowing dysfunction should be considered not only a problem of the oropharyngeal phase but also a problem of the esophageal phase.
OBJECTIVES: This study aimed to determine the relationship between findings from a swallowing study and a history of recurrent pneumonia in pediatric patients.
METHODS: A videofluroscopic swallowing study of 274 pediatric patients who had swallowing dysfunction was conducted. Information on a history of recurrent pneumonia during a 1-y period was obtained from hospital files.
RESULTS: The median age of the participants was 33 months (min =1 0, max=180), of whom 51.8% were females. In the study, 83.2% of the patients had cerebral palsy, 7.7% had syndromic symptoms, 3.6% had muscular dystrophy, and 5.5% were classified as "other." During the 1-y period, 67.9% of the participants had a history of recurrent pneumonia history. Furthermore, 66.4% had oral dysfunction, 32.5% had laryngeal penetration, 46.4% had aspiration, 45.3% had abnormal esophageal body function, and 35.8% had reflux symptoms. There was no correlation between oral dysfunction and recurrent pneumonia ($p=0.902$), but there was a positive correlation between recurrent pneumonia and laryngeal penetration ($p<0.001$, $r=0.26$), aspiration ($p<0.001$, $r =0.49$), abnormal esophageal body function ($p =0.002$, $r=0.18$), and reflux ($p<0.001$, $r=0.22$).
CONCLUSION: Both pharyngeal swallowing disorders, such as penetration and aspiration, and esophageal disorders and reflux may result in recurrent pneumonia in pediatric patients. Thus, all phases of deglutition should be considered and followed up during swallowing evaluation.
DOI: 10.1111/crj.12592
PMID: 27925397 [PubMed - as supplied by publisher]

Can mastication in children with cerebral palsy be analyzed by clinical observation, dynamic ultrasound and 3D kinematics?

Remijn L, Groen BE, Speyer R, van Limbeek J, Vermaire JA, van den Engel-Hoek L, Nijhuis-van der Sanden MW
J Electromyogr Kinesiol. 2016 Nov 29;32:22-29. doi: 10.1016/j.jelekin.2016.11.005. [Epub ahead of print]

The aim of this study was to explore the feasibility of the Mastication Observation and Evaluation (MOE) instrument, dynamic ultrasound and 3D kinematic measurements to describe mastication in children with spastic cerebral palsy and typically developing children. Masticatory movements during five trials of eating a biscuit were assessed in 8 children with cerebral palsy, spastic type (mean age 9.08years) and 14 typically developing children (mean age 9.01years). Differences between trials were tested (t-test) and the mastication of individual children with cerebral palsy was analyzed. MOE scores ranged from 17 to 31 (median 24) for the children with cerebral palsy and from 28 to 32 (median 31) for the typically developing children. There was an increased chewing cycle duration, a smaller left-right and up-down tongue displacement and larger anterior mandible movements for the trials (n=40) of cerebral palsy children ($p<0.000$ for all comparisons) compared to the trials of typically developing children (n=70). The MOE captures differences in mastication between individual children with cerebral palsy. The MOE items 'jaw

movement' and 'fluency and coordination' showed the most similarity with the objective measurements. Objective measurements of dynamic ultrasound and 3D kinematics complemented data from the MOE instrument.

DOI: 10.1016/j.jelekin.2016.11.005
PMID: 27940411 [PubMed - as supplied by publisher]

Challenges in managing drooling in children.
[No authors listed]
Drug Ther Bull. 2015 Jun;53(6):66-8. doi: 10.1136/dtb.2015.6.0331.

Drooling is the unintentional loss of saliva from the mouth, either anteriorly (visible) or posteriorly (with a risk of coughing, vomiting, aspiration and chronic respiratory disorders).(1,2) Anterior drooling is normal in infancy, but is considered neuro-developmentally abnormal if it occurs in children over the age of 4 years old, and is commonly seen in those with physical, intellectual and learning disability, and poor neuromuscular coordination and oral control.(1,3-7) For example, drooling occurs in 10-38% of children with cerebral palsy.(6,8) Drooling is usually due to failure to clear saliva rather than hyper-salivation (sialorrhoea), and a head-down posture and sucking on fingers or clothing may be contributory factors.(1,2,5-7) Here we review the challenges associated with the management of drooling in children.

DOI: 10.1136/dtb.2015.6.0331
PMID: 26069159 [PubMed - indexed for MEDLINE]

Effect of a new treatment protocol called Functional Chewing Training on chewing function in children with cerebral palsy: a double-blind randomised controlled trial.
Serel Arslan S, Demir N, Karaduman AA
J Oral Rehabil. 2016 Nov 17. doi: 10.1111/joor.12459. [Epub ahead of print]

Cerebral palsy (CP) is a group of permanent sensorimotor impairments. Children with CP have various feeding difficulties including chewing disorder, which may affect their nutritional status. Functional Chewing Training (FuCT) was designed as a holistic approach to improve chewing function by providing postural alignment, sensory and motor training, and food and environmental adjustments. This study aimed to investigate the effect of FuCT on chewing function in children with CP. This study was designed as a double-blind, randomised controlled trial. Eighty CP children with chewing disorder were randomised and split between the FuCT group (31 males, 19 females; mean age 3·5 ± 1·9 years) and the control group (16 males, 14 females; 3·4 ± 2·3 years) receiving traditional oral motor exercises. Each group received the training programme for 12 weeks with weekly follow-up and with two evaluations at baseline and end of 12 weeks. Chewing function was evaluated by analysing video recordings and scored with the Karaduman Chewing Performance Scale (KCPS). The Behavioral Pediatrics Feeding Assessment Scale (BPFAS) was used to evaluate feeding behaviours of children. A significant improvement was observed in KCPS scores at 12 weeks after training in the FuCT group ($P < 0·001$), but no change was found in the control group ($P = 0·07$). A significant improvement was detected in all parameters of BPFAS at 12 weeks after training in the FuCT group ($P < 0·001$) and in four parameters of BPFAS in the control group ($P = 0·02$, $P = 0·02$). FuCT is an effective method to improve chewing function compared with traditional oral motor exercises.

DOI: 10.1111/joor.12459
PMID: 27859478 [PubMed - as supplied by publisher]

Management of drooling in children with cerebral palsy: A French survey.
Eur J Paediatr Neurol. 2016 Jul;20(4):524-31. doi: 10.1016/j.ejpn.2016.04.010. Epub 2016 Apr 22.
Chaléat-Valayer E, Porte M, Buchet-Poyau K, Roumenoff-Turcant F, D'Anjou MC, Boulay C, Bernard JC, Touzet S

AIM: To characterise children with cerebral palsy (CP) and pathological drooling in France, and to describe care pathways, assessment and treatment.

METHOD: A transversal, observational, descriptive survey of the practices and opinions of 400 health professionals potentially involved in the care of children with CP, was carried out nationally across France in 2013.
RESULTS: The response rate was 36%. Seventy-five questionnaires were returned and analysed (52%). A small proportion of children were specifically treated for drooling (<25%). Assessments were carried out in 75% of cases and 91% of professionals prescribed treatments. Use of assessment tools varied widely. The most common treatment was oro-facial rehabilitation (95% of professionals), followed by anticholinergic drugs (Scopolamine(®)) (94%) botulinum toxin injections (BT) (66%) and surgery (34%). Scopolamine was considered to be less effective than BT and to have more side effects.
CONCLUSION: The rate of pathological drooling in children with CP is likely underestimated and under treated in France. There is a lack of knowledge regarding assessment tools. Aside from rehabilitation, current practice is to prescribe medication as the first-line treatment, however professionals consider that BT is more effective and has less side effects.

DOI: 10.1016/j.ejpn.2016.04.010
PMID: 27155820 [PubMed - indexed for MEDLINE]

Oral health status of individuals with cerebral palsy at a nationally recognized rehabilitation center.
Al-Allaq T, DeBord TK, Liu H, Wang Y, Messadi DV.
Spec Care Dentist. 2015 Jan-Feb;35(1):15-21. doi: 10.1111/scd.12071. Epub 2014 Apr 7.

Cerebral palsy (CP) is a set of nonprogressive neuromuscular disorders caused by defects in the developing fetal brain. The aim of this study is to investigate the prevalence and distribution of various dental conditions including dental caries and periodontitis among individuals with CP who receive care at the Rancho Los Amigos National Rehabilitation Center dental clinic. Medical records of 478 patients between the ages of 3 and 78 years were reviewed. Patients were divided into four age groups: 3-20, 21-35, 36-55, and 56 and above year old. Data related to their dental conditions including caries, periodontitis, and other oral diseases were assessed. Statistical analyses were conducted to evaluate the correlations between these oral diseases and age, gender, ethnicity as well as their living conditions (home or group home). The 36-55-year-old age group displayed significantly more caries and periodontitis than any other age groups. Individuals aged 3-20 years showed a significantly lower rate of periodontitis and caries. There was no significant association between gender and race with these outcome variables but there was a correlation between these variables and living conditions. Differences in oral health exist among people with CP from different age groups and living conditions. These findings suggest that there is a dire need for more oral hygiene training and education for the care givers. Dental schools should better prepare their graduates to meet the treatment demands of individuals with special healthcare needs.

DOI: 10.1111/scd.12071
PMID: 24708141 [PubMed - indexed for MEDLINE]

Reliability and validity of a tool to measure the severity of tongue thrust in children: the tongue thrust rating scale.
Serel Arslan S, Demir N, Karaduman AA
J Oral Rehabil. 2016 Dec 14. doi: 10.1111/joor.12471. [Epub ahead of print]

OBJECTIVE(S): This study aimed to develop a scale called Tongue Thrust Rating Scale (TTRS), which categorized tongue thrust in children in terms of its severity during swallowing, and to investigate its validity and reliability.
METHODS: The study describes the developmental phase of the TTRS and presented its content and criterion-based validity and inter-observer and intra-observer reliability. For content validation, seven experts assessed the steps in the scale over two Delphi rounds. Two physical therapists evaluated videos of 50 children with cerebral palsy (mean age, 57.9±16.8 months), using the TTRS to test criterion-based validity, inter-observer, and intra-observer reliability. The Karaduman Chewing Performance Scale (KCPS) and Drooling Severity and Frequency Scale (DSFS) were used for criterion-based validity.
RESULTS: All the TTRS steps were deemed necessary. The content validity index was 0.857. A very strong positive correlation was found between two examinations by one physical therapist, which indicated intra-observer reliability ($r = 0.938$, $p < 0.001$). A very strong positive correlation was also found between the TTRS scores of two physical

therapists, indicating inter-observer reliability (r = 0.892, p < 0.001). There was also a strong positive correlation between the TTRS and KCPS (r = 0.724, p < 0.001) and a very strong positive correlation between the TTRS scores and DSFS (r = 0.822 and r = 0.755; p < 0.001). These results demonstrated the criterion-based validity of the TTRS.
CONCLUSIONS: The TTRS is a valid, reliable, and clinically easy-to-use functional instrument to document the severity of tongue thrust in children.

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PMID: 27973693 [PubMed - as supplied by publisher]

Risk factors for dental caries among children with cerebral palsy in a low-resource setting.
Akhter R, Hassan NM, Martin EF, Muhit M, Rahman R, Smithers-Sheedy H, Jones C, Badawi N, Khandaker G
Dev Med Child Neurol. 2016 Dec 9. doi: 10.1111/dmcn.13359. [Epub ahead of print]

AIM: To describe the oral health status and investigate factors affecting dental caries experience among children with cerebral palsy (CP) in rural Bangladesh.
METHOD: A cross-sectional study was conducted among children with CP who are part of the Bangladesh Cerebral Palsy Register (BCPR) study. Caries experience was measured by identifying decayed, missing, and filled teeth for deciduous and permanent teeth (dmft/DMFT). Clinical periodontal index, body mass index, oral hygiene behaviour, masticatory ability, and dietary habits were recorded. CP motor types and severity of functional mobility (Gross Motor Function Classification System [GMFCS]) were assessed.
RESULTS: Of 90 children with CP (mean age 9y 7mo, range 2-17y, 37.8% female and 62.2% male), 35% of 2 to 6 year olds, and 70% of 7 to 11 year olds (p=0.014) experienced caries (dmft+DMFT>0). The mean values (standard deviation [SD]) of dmft and DMFT were 2.46 (3.75) and 0.72 (1.79) respectively. After adjusting for age and sex, inary logistic regression analysis showed a significant relationship with dental caries for children who had quadriplegia (odds ratio [OR] 5.56, p=0.035), tooth cleaning less than one time/day (OR 0.08, p=0.016), using toothpowder or charcoal for cleaning (OR 7.63, p=0.015), and snacking between meals more than one time/day (OR 6.93, p=0.012).
INTERPRETATION: Early oral health preventive care is required for children with CP because dental caries is highly prevalent in these children.

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PMID: 27935024 [PubMed - as supplied by publisher]

Troubles visuels

Ocular findings in patients with spastic type cerebral palsy.
Park MJ, Yoo YJ, Chung CY, Hwang JM
BMC Ophthalmol. 2016 Nov 8;16(1):195.

BACKGROUND: Refractive errors, strabismus, nystagmus, amblyopia, and cortical visual impairment are observed in 50 to 90 % of patients with cerebral palsy. Ocular abnormalities are known to differ according to cerebral palsy type, and spastic type has been reported to be more likely to be associated with ocular defects than the athetoid and ataxic types.
METHODS: A retrospective review of medical records was performed on 105 consecutive children with spastic type of cerebral palsy who underwent ophthalmologic examination between July 2003 and March 2006. The complete ophthalmological examination included measurement of visual acuity, ocular motility, stereoacuity, binocular vision, cycloplegic refraction along with the evaluation of the anterior segment and the posterior segment.
RESULTS: The most common ocular abnormality was strabismus (70.5 %) followed by refractive errors (53.3 %). Exodeviation was more commonly found than esodeviation (46 vs 27 patients), and hyperopia was much more prevalent than myopia. A considerable number of patients with strabismus had abnormal ocular motility wherein 16 patients showed inferior oblique overaction and ten superior oblique overaction. Whereas inferior oblique overaction was accompanied similarly in exotropia and esotropia, superior oblique overaction was accompanied more by exotropia.

CONCLUSIONS: Children with spastic type cerebral palsy have a high prevalence of strabismus and refractive errors. Exotropia and hyperopia are the most common ocular abnormalities. All children with spastic type of cerebral palsy may require a detailed ophthalmologic evaluation.

Free PMC Article
DOI: 10.1186/s12886-016-0367-1
PMCID: PMC5100247
PMID: 27821110 [PubMed - in process]

Fatigue

Fatigue and its relationship with physical activity, age, and body composition in adults with cerebral palsy.
McPhee PG, Brunton LK, Timmons BW, Bentley T, Gorter JW.
Dev Med Child Neurol. 2016 Nov 14. doi: 10.1111/dmcn.13306. [Epub ahead of print]

AIM: The objectives of this exploratory study were (1) to describe the experience of fatigue in adults with cerebral palsy (CP) inclusive of all levels of the Gross Motor Function Classification System (GMFCS); and (2) to determine if physical activity level, sedentary time, age, or body composition can predict fatigue in adults with CP.
METHOD: An observational study was conducted in an outpatient setting in Ontario, Canada. Participants included adults with CP (n=41; GMFCS levels I-V; mean age 33.7y, standard deviation [SD] 12.3y). Fatigue was measured using the Fatigue Impact and Severity Self-Assessment (FISSA) questionnaire. Habitual physical activity and sedentary time were measured using accelerometry. Body mass index (BMI) and waist circumference were reported as measures of body composition.
RESULTS: The mean (SD) FISSA score for all participants was 84.5 (30.6), ranging from 54.0 (18.3) (GMFCS level I) to 93.6 (21.9) (GMFCS level V). Significant positive relationships (regression coefficient β [95% confidence intervals]) were observed between BMI and FISSA scores (1.9 [0.73-3.1]), waist circumference and FISSA scores (0.71 [0.19-1.2]), and age and FISSA scores (0.99 [0.26-1.7]). A significant negative relationship was observed between moderate-to-vigorous physical activity (MVPA) per hour and FISSA scores -6.4 [-12 to -0.83]). Backwards stepwise regression analysis revealed BMI (1.8 [0.61-2.9]) and MVPA per hour (-5.4 [-10 to -0.30]) were significant predictors of FISSA scores.
INTERPRETATION: Health care providers should consider the importance of weight management and physical activity to prevent and treat fatigue in this population.

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PMID: 27861776 [PubMed - as supplied by publisher]

Troubles de la croissance

Hypopituitarism in children with cerebral palsy.
Uday S, Shaw N, Krone R, Kirk J.
Arch Dis Child. 2016 Oct 27. pii: archdischild-2016-311012. doi: 10.1136/archdischild-2016-311012. [Epub ahead of print]

Poor growth and delayed puberty in children with cerebral palsy is frequently felt to be related to malnutrition. Although growth hormone deficiency is commonly described in these children, multiple pituitary hormone deficiency (MPHD) has not been previously reported. We present a series of four children with cerebral palsy who were born before 29 weeks gestation who were referred to the regional endocrinology service, three for delayed puberty and one for short stature, in whom investigations identified MPHD. All patients had a height well below -2 standard deviation score (2nd centile) at presentation and three who had MRI scans had an ectopic posterior pituitary gland. We therefore recommend that the possibility of MPHD should be considered in all children with cerebral palsy and poor growth or delayed puberty. Early diagnosis and treatment is essential to maximise growth and prevent associated morbidity and mortality.

DOI: 10.1136/archdischild-2016-311012
PMID: 27789461 [PubMed - as supplied by publisher]

Qualité de vie et rapport au monde

Qualité de vie

Child and youth experiences and perspectives of cerebral palsy: a qualitative systematic review.
Lindsay S
Child Care Health Dev. 2016 Mar;42(2):153-75. doi: 10.1111/cch.12309. Epub 2016 Jan 11.

BACKGROUND: Cerebral palsy (CP) is one of the most common causes of physical disability in childhood, and many children with CP access rehabilitation services throughout their lives. The aim of this qualitative systematic review was to synthesize the experiences and perspectives of youth living with CP to inform the development of rehabilitation and social programmes.
METHODS: A thematic qualitative synthesis integrating qualitative evidence was undertaken where six electronic databases (MEDLINE, Embase, Healthstar, Cumulative Index to Nursing and Allied Health Literature, Proquest and PsychInfo) were searched from 1980 to September 2014.
RESULTS: Thirty-three articles involving 390 youth, aged from 2 to 25 years, across six countries were included. Themes were classified according to the International Classification of Functioning Child and Youth Version framework. Youth's accounts focused on social inclusion and the physical environment (i.e. services and supports, transportation, accessibility, accommodations, safety and weather), the role of family and peers and participation (i.e. leisure and recreation, school and civic engagement). Youth described how body structure and function (i.e. pain and physical functioning, mental health, fatigue and unpredictability of body function) affected them - often disrupting their biographies. Some youth described personal factors such as independence, coping and body image that affected their ability to cope with their condition. There was much less focus on youth's experiences of mobility, activities of daily living and assistive devices.
CONCLUSIONS: Youth with CP experience pain, fatigue and impairments to body function, along with social exclusion, which can affect their biographies. However, youth had strategies to revise their biographies to maintain personal and social normalcy.

DOI: 10.1111/cch.12309
PMID: 26754030 [PubMed - indexed for MEDLINE]

Health-Related Quality of Life in Children and Adolescents with Cerebral Palsy: A Secondary Analysis of the DISABKIDS Questionnaire in the Field-Study Cerebral Palsy Subgroup.
Mueller-Godeffroy E, Thyen U, Bullinger M
Neuropediatrics. 2016 Apr;47(2):97-106. doi: 10.1055/s-0036-1571801. Epub 2016 Feb 15.

INTRODUCTION: Health-related quality of life (HRQOL) instruments are increasingly being used to evaluate interventions and therapy outcomes in children and adolescents with cerebral palsy (CP). A variety of psychometrically sound and validated generic and disease-specific instruments are available. A third type of instrument, the chronic-generic instrument, pertains to features of HRQOL that are shared by various chronic conditions.The DISABKIDS family of questionnaires consists of a chronic-generic core measure (DCGM-37) and several condition-specific modules, among these, a CP module (CPM). The objective of this article was to describe the performance and, specifically, the validity of the DCGM-37 and CPM in children and adolescents with CP.
METHODS: Psychometric properties of the DCGM-37 and the CPM are presented. The discriminant validity was assessed compared with generic measures of HRQOL regarding different levels of impairment (physical independence; developmental delay).
RESULTS: A total of 86 patients with CP (mean age 13 years, range 7-19 years) and 78 main caretakers participated in this study. The DCGM-37 and CPM showed much better discriminative ability as compared with generic questionnaires.

CONCLUSIONS: The DCGM-37 and CPM were able to differentiate between patients with different levels of impairment and can be recommended for treatment evaluation and group comparison in clinical studies of children and adolescents with CP.
Georg Thieme Verlag KG Stuttgart · New York.
DOI: 10.1055/s-0036-1571801
PMID: 26878168 [PubMed - indexed for MEDLINE]

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]

Background and purpose - 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 ≥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.
DOI: 10.1080/17453674.2016.1262685
PMID: 27892753 [PubMed - as supplied by publisher]

Study on the quality of life of children with cerebral palsy.
Park SK, Yang DJ, Heo JW, Kim JH, Park SH, Uhm YH
J Phys Ther Sci. 2016 Nov;28(11):3145-3148. Epub 2016 Nov 29.

[Purpose] This study aims to analyze the factors that affect the quality of life of children with cerebral palsy.
[Subjects and Methods] The study subjects were 138 children, aged 7-12, who suffer from cerebral palsy. Factors affecting subjects' quality of life were evaluated using the ICF-CY; quality of life was evaluated using the KIDSCREEN 52 - Health-Related Quality of Life questionnaire. Multiple regression analysis was conducted.
[Results] The factors related to physical functions that affect subjects' quality of life were mental function, sensory function and pain, genitourinary and reproductive function, as well as neuromusculoskeletal and movement-related functions. Factors related to activities and participation were learning and applying knowledge, self-care, interpersonal interactions and relationships, major life areas, and community, social and civic life. Lastly, factors related to the environment were products and technology, natural environment and human made changes to environment, and attitude.
[Conclusion] In order to improve the quality of life of children with cerebral palsy, the compound effects of several factors should be comprehensively considered without being limited to a specific variable from physical function. And children should be provided with ample opportunities to participate in diverse activities and their physical functions, as well as the environmental factors, should improve.
Free PMC Article
DOI: 10.1589/jpts.28.3145
PMCID: PMC5140817
PMID: 27942137 [PubMed - in process]

Translation and validation of the Brazilian version of the Cerebral Palsy Quality of Life Questionnaire for Children - child report.
Braccialli LM, Almeida VS, Sankako AN, Silva MZ, Braccialli AC, Carvalho SM, Magalhães AT
J Pediatr (Rio J). 2016 Mar-Apr;92(2):143-8. doi: 10.1016/j.jped.2015.05.005. Epub 2015 Dec 14.

OBJECTIVE: To verify the psychometric properties of the Cerebral Palsy: Quality of Life Questionnaire Children - child report (CPQol-Child) questionnaire, after it was translated and culturally adapted into Brazilian Portuguese.
METHODS: After the translation and cultural adaptation of the tool into Brazilian Portuguese, the questionnaire was answered by 65 children with cerebral palsy, aged 9-12 years. The intraclass correlation coefficient and Cronbach's alpha were used to assess the reliability and internal consistency of the tool and its validity was analyzed through the association between CPQol-Child: self-report tool and Kidscreen-10 using Pearson's correlation coefficient.
RESULTS: Internal consistency ranged from 0.6579 to 0.8861, the intraobserver reliability from 0.405 to 0.894, and the interobserver from 0.537 to 0.937. There was a weak correlation between the participation domain and physical health of CPQol-Child: self-report tool and Kidscreen-10.
CONCLUSION: The analysis suggests that the tool has psychometric acceptability for the Brazilian population.

Free Article
DOI: 10.1016/j.jped.2015.05.005
PMID: 26699433 [PubMed - indexed for MEDLINE]

Activité physique

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]

AIM: 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.
METHOD: 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.
RESULTS: 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.
INTERPRETATION: 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.

DOI: 10.1111/dmcn.13340
PMID: 27901269 [PubMed - as supplied by publisher]

Developing a Clinical Protocol for Habitual Physical Activity Monitoring in Youth With Cerebral Palsy.
Nicholson K, Weaver A, George A, Hulbert R, Church C, Lennon N.
Pediatr Phys Ther. 2017 Jan;29(1):2-7.

PURPOSE: The StepWatch (SW) has been used to monitor physical activity (PA) in youth with cerebral palsy; however, there is no standard collection protocol. The goal was to develop such a protocol.

METHODS: Data were examined from patients who wore the SW for 8 to 14 days. The Spearman-Brown prediction formula determined the minimum number of days for reliable PA. Weekdays were compared to weekends and 10- and 60-second collection intervals were examined.
RESULTS: The PA data were collected from 98 youth with cerebral palsy. Results showed 3 days would provide reliable representation of PA, participants took significantly more steps during school days compared with weekends, and there were no differences between collection intervals.
CONCLUSIONS: We recommend setting the SW for 7 days at 10-second collection rate. Data should be analyzed if at least 3 days of data are present. Weekdays and weekend days should be noted, and both included when possible.
DOI: 10.1097/PEP.0000000000000320
PMID: 27984456 [PubMed - in process]

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.
DOI: 10.3138/ptc.2015-38LHC
PMCID: PMC5125497 [Available on 2017-01-01]
PMID: 27904240 [PubMed - in process]

Habitual Physical Activity in Children With Cerebral Palsy Aged 4 to 5 Years Across All Functional Abilities.
Keawutan P, Bell KL, Oftedal S, Davies PS, Ware RS, Boyd RN.
Pediatr Phys Ther. 2017 Jan;29(1):8-14

PURPOSE: To compare ambulatory status in children with cerebral palsy aged 4 to 5 years with their habitual physical activity and time spent sedentary, and to compare their activity with physical activity guidelines.
METHODS: Sixty-seven participants-independently ambulant, marginally ambulant, and nonambulant-wore accelerometers for 3 days. Time spent sedentary as a percentage of wear time and activity counts were compared between groups.
RESULTS: There were significant differences in time spent sedentary and activity counts between groups. Children who were independently ambulant were more likely to meet physical activity guidelines.
CONCLUSION: Children with cerebral palsy spent more than half of their waking hours in sedentary time. Interventions to reduce sedentary behavior and increase habitual physical activity are needed in children with cerebral palsy at age 4 to 5 years.
DOI: 10.1097/PEP.0000000000000327
PMID: 27984458 [PubMed - in process]

Physical activity and walking performance: Influence on quality of life in ambulatory children with cerebral palsy (CP).

Mann K, Tsao E, Bjornson KF
J Pediatr Rehabil Med. 2016 Dec 2;9(4):279-286.

PURPOSE: To examine the relationship of physical activity (PA) and walking performance to QOL in ambulatory children with CP, as function is not consistently associated with QOL in this population.
METHODS: A secondary analysis of a cross-sectional cohort of 128 ambulatory children with CP, ages 2.2-9.9 years and GMFCS levels I-III, was employed. Individual multivariate regression models were developed for physical, psychosocial, and total domains of QOL as measured by the Pediatric Quality of Life Inventory (PedsQL) controlling for physical activity and walking performance, participation level and frequency, topography of CP, walking capacity, age, and satisfaction with participation.
RESULTS: Physical, psychosocial and total QOL averaged 52.2, 60.9, and 56.5 respectively. PA was positively associated with physical (0.64, $p < 0.01$) and total QOL (0.54, $p < 0.01$). Walking performance was associated with physical QOL (0.16, $p = 0.05$), participation level was positively related to psychosocial (0.44, $p < 0.01$), and age negatively for all QOL domains (> -0.43, $p < 0.01$).
CONCLUSIONS: Physical activity, walking performance, and level of participation in daily life are associated with varying domains of QOL. Future work should explore factors that influence the relationship of daily physical/walking activity and participation to QOL in children with ambulatory CP as they age.
DOI: 10.3233/PRM-160395
PMID: 27935563 [PubMed - in process]

Physical activity predicts quality of life and happiness in children and adolescents with cerebral palsy.
Maher CA, Toohey M, Ferguson M
Disabil Rehabil. 2016;38(9):865-9. doi: 10.3109/09638288.2015.1066450. Epub 2015 Jul 28.

PURPOSE: To examine the associations between physical activity, health-related quality of life and happiness in young people with cerebral palsy.
METHOD: A total of 70 young people with cerebral palsy (45 males, 25 females; mean age 13 years 11 months, SD 2 years 0 month) took part in a cross-sectional, descriptive postal survey assessing physical activity (Physical Activity Questionnaire for Adolescents), functional ability (Gross Motor Function Classification System), quality of life (Pediatric Quality of Life Inventory 4.0) and happiness (single Likert-scale item). Relationships between physical activity, quality of life and happiness were examined using backward stepwise linear regression.
RESULTS: Physical activity significantly predicted physical quality of life ($R(2) = 0.64$, $\beta = 6.12$, $p = 0.02$), social quality of life ($R(2) = 0.28$, $\beta = 9.27$, $p < 0.01$) and happiness ($R(2) = 0.08$, $\beta = 0.9$, $p = 0.04$). Physical activity was not associated with emotional or school quality of life.
CONCLUSIONS: This study found a positive association between physical activity, social and physical quality of life, and happiness in young people with cerebral palsy. Findings underscore the potential benefits of physical activity for the wellbeing of young people with cerebral palsy, in addition to its well-recognised physical and health benefits.
IMPLICATIONS FOR REHABILITATION: Physical activity is a key predictor of quality of life and happiness in young people with cerebral palsy. Physical activity is widely recognised as having physical health benefits for young people with cerebral palsy; however, this study also highlights that it may have important benefits for wellbeing, quality of life and happiness. This emphasises the need for clinical services and intervention studies aimed specifically at increasing physical activity amongst children and adolescents with cerebral palsy.
DOI: 10.3109/09638288.2015.1066450
PMID: 26218617 [PubMed - indexed for MEDLINE]

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.

AIM: 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.
DESIGN: A systematic review using a mixed methods design.

DATA SOURCES: A wide range of databases, including Web of Science, PubMed, BMJ Best Practice, NHS EED, CINAHL, AMED, NICAN, PsychINFO, were searched for quantitative, qualitative and health economics evidence.
ELIGIBILITY: 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.
RESULTS: 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.
CONCLUSIONS: 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.
TRIAL REGISTRATION NUMBER: CRD42013003939.
Free PMC Article
DOI: 10.1136/bmjsem-2016-000109
PMCID: PMC5125427
PMID: 27900176 [PubMed - in process]

Prise en charge et Accompagnant/Accompagnement

Delivering healthcare services to children with cerebral palsy and their families: a narrative review.
Hayles E, Jones A, Harvey D, Plummer D, Ruston S.
Health Soc Care Community. 2015 May;23(3):242-51. doi: 10.1111/hsc.12121. Epub 2014 Sep 1.
Children with cerebral palsy have complex healthcare needs and often require complex multidisciplinary care. It is important for clinicians to understand which approaches to healthcare service delivery for this population are supported in the literature and how these should be applied in clinical practice. This narrative review aims to identify and review the evidence for current approaches to healthcare service delivery for children with cerebral palsy. Databases were searched using key terms to identify relevant research articles and grey literature from December 2011 to September 2013. Search results were screened and sorted according to inclusion and exclusion criteria. Thirty-two documents were included for evaluation and their content was analysed thematically. Three current approaches to healthcare service delivery for children with cerebral palsy identified in this narrative review were family-centred care, the World Health Organisation's International Classification of Functioning, Disability and Health, and collaborative community-based primary care. However, healthcare services for children with cerebral palsy and their families are inconsistently delivered according to these approaches and the identified guidelines or standards of care for children with cerebral palsy have limited incorporation of these approaches. Future research is required to investigate how these approaches to healthcare service delivery can be integrated into clinical practices to enable clinicians to improve services for this population.

DOI: 10.1111/hsc.12121
PMID: 25175322 [PubMed - indexed for MEDLINE]

"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.

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PMCID: PMC5104752
PMID: 27891110 [PubMed - in process]

Parental stress in mothers of children and adolescents with cerebral palsy.[Article in English, Portuguese, Spanish]

Ribeiro MF, Sousa AL, Vandenberghe L, Porto CC

Rev Lat Am Enfermagem. 2014 May-Jun;22(3):440-7.

OBJECTIVES: to evaluate parental stress of mothers of children and adolescents with cerebral palsy; to verify whether parental stress undergoes variations according to the level of motor compromise, the child's phase of life, and sociodemographic variables.
METHOD: a cross-sectional, descriptive study, with 223 mothers of children and adolescents with cerebral palsy.
RESULTS: 45.3% of the mothers presented high levels of stress; there were differences in stress between mothers of children with mild and severe motor impairment; mothers of older children were more stressed than mothers of younger children and of adolescents; paid work and leisure activities reduced the stress.
CONCLUSION: mothers of children and adolescents with cerebral palsy, whose children present mild to severe motor impairment are vulnerable to parental stress. Paid work and leisure activities were the factors that contributed most to reducing the stress.

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PMCID: PMC4292615
PMID: 25029055 [PubMed - indexed for MEDLINE]

Parenting acceptance and commitment therapy: a randomised controlled trial of an innovative online course for families of children with cerebral palsy.

Whittingham K, Sheffield J, Boyd RN

BMJ Open. 2016 Oct 19;6(10):e012807. doi: 10.1136/bmjopen-2016-012807.

INTRODUCTION: Cerebral palsy (CP) impacts on the entire family in a manner that is long-term, complex and multifactorial. In addition, the quality of the parent-child relationship impacts on many and varied child outcomes, making the provision of easily accessible and evidence-based support to parents of children with CP a priority. This paper reports the protocol of a randomised controlled trial of an innovative and translatable online intervention, parenting acceptance and commitment therapy (PACT), for families of children with CP. We predict that participating in the PACT programme will be associated with improvements in the parent-child relationship, in child functioning and in adjustment and quality of life for both parent and child.
METHODS AND ANALYSIS: We aim to recruit 66 parents of children (2-10 years old) diagnosed with CP to this study. Families will be randomly assigned to two groups: wait-list control and PACT. PACT is a parenting intervention

grounded in acceptance and commitment therapy (ACT) and developed into an online course 'PARENT101 Parenting with Purpose' using the edX platform. All participants will be offered PACT before completion of the study. Assessments will take place at baseline, following completion of PACT and at 6-month follow-up (retention) and will focus on the parent-child relationship, parent and child adjustment and parent and child quality of life. Analysis will follow standard methods for randomised controlled trials using general linear models, specifically analysis of variance or analysis of covariance.
ETHICS AND DISSEMINATION: Ethics approvals have been obtained through the Children's Health Queensland Hospital and Health Service Human Research Ethics Committee (HREC/15/QRCH/115) and The University of Queensland (2015001743). If efficacy is demonstrated, then the PARENT101 course has the potential to be disseminated widely in an accessible manner and at minimal cost. Further, the PACT framework may provide a blueprint for similar online courses with parents in a full range of contexts.
TRIAL REGISTRATION NUMBER: ACTRN12616000351415; Pre-results.

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DOI: 10.1136/bmjopen-2016-012807
PMCID: PMC5073654
PMID: 27798022 [PubMed - in process]

Parents' Experiences of Health Care for Their Children With Cerebral Palsy.
Hayles E, Harvey D, Plummer D, Jones A
Qual Health Res. 2015 Aug;25(8):1139-54. doi: 10.1177/1049732315570122. Epub 2015 Feb 23.

Although current health care service delivery approaches for children with cerebral palsy recognize the importance of including parents in the health care of their child, we do not yet understand how parents experience this phenomenon. In this study, we used grounded theory methodology to explore parents' experiences of health care for their children with cerebral palsy living in a regional area of Australia. Our findings indicate that parents experience health care for their child as a cyclical process of "making the most of their body and their life." Important aspects of care include "learning as you go," "navigating the systems," "meeting needs through partnership," "being empowered or disempowered," and "finding a balance." We suggest modifications to health care service delivery practices that might contribute to improved experiences of health care for this population.

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