Science Infos

Paralysie Cérébrale

N°35 AVRIL 2017

FOCUS

APPEL D'OFFRE GRAND PROJET 2018

Cette année, la Fondation Paralysie Cérébrale/La Fondation Motrice a décidé de consacrer un soutien massif et inédit à la recherche sur la Paralysie Cérébrale, à travers son appel d'offre 2018.

Cet appel d'offre évaluera des projets d'une enveloppe globale de 500 k€ à 1,5 M€ maximum répartie sur une période de 3 à 5 ans. Il pourra s'agir de projets de recherche clinique, translationnelle, de santé publique ou de sciences humaines et sociales de grande envergure évaluant une (des) intervention(s) destinée(s) à :

o Améliorer les déficiences, les activités et la participation des personnes atteintes, prévenir, réduire ou atténuer les conséquences à moyen et long terme de la Paralysie Cérébrale,

o Prévenir la survenue de la Paralysie Cérébrale dans des populations à risque.

Cet appel à projets de recherche s'adresse à toute équipe de recherche labellisée, située dans les pays européens. Les projets de recherche proposés devront reposer sur un consortium dont le coordinateur sera un leader travaillant en France

N'hésitez pas à diffuser cet appel d'offre auprès de vos collègues, collaborateurs et auprès de toute équipe ou toutes personnes de votre connaissance potentiellement intéressées par le soutien de la Fondation.

Les documents relatifs à cet appel d'offre peuvent être téléchargés ci-dessous :

- Cadre général de l'appel d'offre (français)
- General framework of the call (anglais)
- Synopsis du projet (anglais)
- Dossier de candidature (anglais)

Date limite d'envoi du synopsis du projet par les candidats : **30 novembre 2017 au plus tard**

Date d'envoi du dossier de candidature : **15 janvier 2018**.

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Manifestations et congrès

Juin 2017

Congrès Réseau Breizh - Sferhe – CDI
"La paralysie cérébrale au fil du temps »
26-27 juin 2017
Saint Malo, France
http://www.tmsevents.fr/congres/2017/sferhe/

Octobre 2017

32e congrès de la SOFMER
05-07 octobre 2017
Nancy, France
http://nancy.sofmer2017.com/index.php?pageID=09eb828f52123930a2186e7b5a4db890

European Congress of NeuroRehabilitation (ECNR)
24-27 octobre 2017
Lausanne, Suisse
http://www.ecnr-congress.org/

Novembre 2017

Journées d'études polyhandicap Paralysie cérébrale 2017
16-17 Novembre 2017
Paris, France
https://www.institutmc.org/index.php/annonce-journe-es-polyhandicap-paralysie-ce-re-brale-novembre-2017

Décembre 2017

Journées d'études annuelles du CDI
« L'axe corporel du paralysé cérébral dans ses dimensions motrice, perceptives et orthopédiques »
11-12 décembre 2017
Lyon, France
https://www.institutmc.org/index.php/24-news-colloques/133-journee-d-etude-du-cdi-2017-a-lyon

Juillet 2018

12 th International Society of Physical and Rehabilitation Medicine (ISPRM) World Congress
08-12 juillet 2018
Paris, France
http://www.isprm2018.com/

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

Epidémiologie

Facteurs de risque – Causes

Association Between Early Low-Dose Hydrocortisone Therapy in Extremely Preterm Neonates and Neurodevelopmental Outcomes at 2 Years of Age.
Baud O Trousson C, Biran V, Leroy E, Mohamed D, Alberti C; PREMILOC Trial Group.
JAMA. 2017 Apr 4;317(13):1329-1337. doi: 10.1001/jama.2017.2692. Comment in JAMA. 2017 Apr 4;317(13):1317-1318.

Importance: Dexamethasone to prevent bronchopulmonary dysplasia in very preterm neonates was associated with adverse neurodevelopmental events. Early low-dose hydrocortisone treatment has been reported to improve survival without bronchopulmonary dysplasia but its safety with regard to neurodevelopment remains to be assessed.
Objective: To assess whether early hydrocortisone therapy in extremely preterm infants is associated with neurodevelopmental impairment at 2 years of age. Design, Setting, and Participants: An exploratory secondary analysis of the PREMILOC (Early Low-Dose Hydrocortisone to Improve Survival without Bronchopulmonary Dysplasia in Extremely Preterm Infants) randomized clinical trial conducted between 2008 and 2014 in 21 French neonatal intensive care units. Randomization was stratified by gestational age groups. Neurodevelopmental assessments were completed from 2010 to 2016. Interventions: After birth, patients were randomly assigned to receive placebo or hydrocortisone (0.5 mg/kg twice per day for 7 days, followed by 0.5 mg/kg per day for 3 days). Main Outcomes and Measures: The prespecified exploratory secondary outcome of neurodevelopmental impairment was based on a standardized neurological examination and the revised Brunet-Lézine scale (global developmental quotient score and subscores; mean norm, 100 [SD, 15]). The minimal clinically important difference on the global developmental quotient was 5 points.
Results: Of 1072 neonates screened, 523 were assigned to hydrocortisone (n = 256) or placebo (n = 267) and 406 survived to 2 years of age. A total of 379 patients (93%; 46% female) were evaluated (194 in the hydrocortisone group and 185 in the placebo group) at a median corrected age of 22 months (interquartile range, 21-23 months). The distribution of patients without neurodevelopmental impairment (73% in the hydrocortisone group vs 70% in the placebo group), with mild neurodevelopmental impairment (20% in the hydrocortisone group vs 18% in the placebo group), or with moderate to severe neurodevelopmental impairment (7% in the hydrocortisone group vs 11% in the placebo group) was not statistically significantly different between groups (P = .33). The mean global developmental quotient score was not statistically significantly different between groups (91.7 in the hydrocortisone group vs 91.4 in the placebo group; between-group difference, 0.3 [95% CI, -2.7 to 3.4]; P = .83). The incidence of cerebral palsy or other major neurological impairments was not significantly different between groups. Conclusions and Relevance: In this exploratory analysis of secondary outcomes of a randomized clinical trial of extremely preterm infants, early low-dose hydrocortisone was not associated with a statistically significant difference in neurodevelopment at 2 years of age. Further randomized studies are needed to provide definitive assessment of the neurodevelopmental safety of hydrocortisone in extremely preterm infants.
Trial Registration: clinicaltrials.gov Identifier: NCT00623740.
DOI: 10.1001/jama.2017.2692
PMID: 28384828

Association Between Maternal Body Mass Index in Early Pregnancy and Incidence of Cerebral Palsy.
Villamor E, Tedroff K, Peterson M, Johansson S, Neovius M, Petersson G, Cnattingius S.
JAMA. 2017 Mar 7;317(9):925-936. doi: 10.1001/jama.2017.0945.

Importance: Maternal overweight and obesity are associated with increased risks of preterm delivery, asphyxia-related neonatal complications, and congenital malformations, which in turn are associated with increased risks of cerebral palsy. It is uncertain whether risk of cerebral palsy in offspring increases with maternal overweight and obesity severity and what could be possible mechanisms.
Objective: To study the associations between early pregnancy body mass index (BMI) and rates of cerebral palsy by gestational age and to identify potential mediators of these associations. Design, Setting, and Participants: Population-based retrospective cohort study of women with singleton children born in Sweden from 1997 through 2011. Using national registries, children were followed for a cerebral palsy diagnosis through 2012.
Exposures: Early pregnancy BMI.
Main Outcomes and Measures: Incidence rates of cerebral palsy and hazard ratios (HRs) with 95% CIs, adjusted for maternal age, country of origin, education level, cohabitation with a partner, height, smoking during pregnancy, and year of delivery.
Results: Of 1 423 929 children included (mean gestational age, 39.8 weeks [SD, 1.8]; 51.4% male), 3029 were diagnosed with cerebral palsy over a median 7.8 years of follow-up (risk, 2.13 per 1000 live births; rate, 2.63/10 000 child-years). The percentages of mothers in BMI categories were 2.4% at BMI less than 18.5 (underweight), 61.8% at BMI of 18.5 to 24.9 (normal weight), 24.8% at BMI of 25 to 29.9 (overweight), 7.8% at BMI of 30 to 34.9 (obesity grade 1), 2.4% at BMI of 35 to 39.9 (obesity grade 2), and 0.8% at BMI 40 or greater (obesity grade 3). The number of cerebral palsy cases in each BMI category was 64, 1487, 728, 239, 88, and 38; and the rates per 10 000 child-years were 2.58, 2.35, 2.92, 3.15, 4.00, and 5.19, respectively. Compared with children of normal-weight mothers, adjusted HR of cerebral palsy were 1.22 (95% CI, 1.11-1.33) for overweight, 1.28 (95% CI, 1.11-1.47) for obesity grade 1, 1.54 (95% CI, 1.24, 1.93) for obesity grade 2, and 2.02 (95% CI, 1.46-2.79) for obesity grade 3. Results were statistically significant for children born at full term, who comprised 71% of all children with cerebral palsy, but not for preterm infants. An estimated 45% of the association between maternal BMI and rates of cerebral palsy in full-term children was mediated through asphyxia-related neonatal morbidity.
Conclusions and Relevance: Among Swedish women with singleton children, maternal overweight and obesity were significantly associated with the rate of cerebral palsy. The association was limited to children born at full term and was partly mediated through asphyxia-related neonatal complications.
DOI: 10.1001/jama.2017.0945
PMID: 28267854 [Indexed for MEDLINE]

Long-term childhood outcomes of breech presentation by intended mode of delivery: a population record linkage study.
Bin YS, Ford JB, Nicholl MC, Roberts CL.
Acta Obstet Gynecol Scand. 2017 Mar;96(3):342-351. doi: 10.1111/aogs.13086. Epub 2017 Feb 9.

INTRODUCTION: There is a lack of information on long-term outcomes by mode of delivery for term breech presentation. We aimed to compare childhood mortality, cerebral palsy, hospitalizations, developmental, and educational outcomes associated with intended vaginal breech birth (VBB) with planned cesarean section.
MATERIAL AND METHODS: Population birth and hospital records from New South Wales, Australia, were used to identify women with non-anomalous pregnancies eligible for VBB during 2001-2012. Intended mode of delivery was inferred from labor onset and management. Death, hospital, and education records were used for follow up until 2014. Cox proportional hazards regression and modified Poisson regression were used for analysis.
RESULTS: Of 15 281 women considered eligible for VBB, 7.7% intended VBB, 74.2% planned cesarean section, and intention was uncertain for 18.1%. Intended VBB did not differ from planned cesarean section on infant mortality (Fisher's exact p = 0.55), childhood mortality (Fisher's exact p = 0.50), cerebral palsy (Fisher's exact p = 1.00), hospitalization in the first year of life [adjusted hazard ratio (HR) 1.04; 95% CI 0.90-1.20], hospitalization between the first and sixth birthdays (HR 0.92; 95% CI 0.82-1.04), being developmentally vulnerable [adjusted relative risk (RR) 1.22; 95% CI 0.48-1.69] or having special needs status (RR 0.95; 95% CI 0.48-1.88) when aged 4-6, or scoring more than 1 standard deviation below the mean on tests of reading (RR 1.10; 95% CI 0.87-1.40) and numeracy (RR 1.04; 95% CI 0.81-1.34) when aged 7-9.

CONCLUSIONS: Planned VBB confers no additional risks for child health, development or educational achievement compared with planned cesarean section. © 2016 Nordic Federation of Societies of Obstetrics and Gynecology.
DOI: 10.1111/aogs.13086
PMID: 28029180 [Indexed for MEDLINE]

Génétique

A de novo deletion in a boy with cerebral palsy suggests a refined critical region for the 4q21.22 microdeletion syndrome.
Zarrei M, Merico D, Kellam B, Engchuan W, Scriver T, Jokhan R, Wilson MD, Parr J, Lemire EG, Stavropoulos DJ, Scherer SW.
Am J Med Genet A. 2017 May;173(5):1287-1293. doi: 10.1002/ajmg.a.38176. Epub 2017Apr 3.

We present an 18-year-old boy with cerebral palsy, intellectual disability, speech delay, and seizures. He carries a likely pathogenic 1.3 Mb de novo heterozygous deletion in the 4q21.22 microdeletion syndrome region. He also carries a 436 kb maternally-inherited duplication impacting the first three exons of CHRNA7. The majority of previously published cases with 4q21.22 syndrome shared common features including growth restriction, muscular hypotonia, and absent or severely delayed speech. Using copy number variation (CNV) data available for other subjects, we defined a minimal critical region of 170.8 kb within the syndromic region, encompassing HNRNPD. We also identified a larger 2 Mb critical region encompassing ten protein-coding genes, of which six (PRKG2, RASGEF1B, HNRNPDL, HNRNPD, LIN54, COPS4) have a significantly low number of truncating loss-of-function mutations. Long-range chromatin interaction data suggest that this deletion may alter chromatin interactions at the 4q21.22 microdeletion region. We suggest that the deletion or misregulation of these genes is likely to contribute to the neurodevelopmental and neuromuscular abnormalities in 4q21.22 syndrome.

DOI: 10.1002/ajmg.a.38176
PMID: 28371330 [Indexed for MEDLINE]

Lésions - Prévention des lesions

Données fondamentales

Blocked, Delayed, or Obstructed: What Causes Poor White Matter Development in Intrauterine Growth Restricted Infants?
Tolcos M, Petratos S, Hirst JJ, Wong F, Spencer SJ, Azhan A, Emery B, Walker DW
Prog Neurobiol. 2017 Apr 6. pii: S0301-0082(16)30023-5. doi: 10.1016/j.pneurobio.2017.03.009. [Epub ahead of print]

Poor white matter development in intrauterine growth restricted (IUGR) babies remains a major, untreated problem in neonatology. New therapies, guided by an understanding of the mechanisms that underlie normal and abnormal oligodendrocyte development and myelin formation, are required. Much of our knowledge of the mechanisms that underlie impaired myelination come from studies in adult demyelinating disease, preterm brain injury, or experimental models of hypoxia-ischemia. However relatively less is known for IUGR which is surprising because IUGR is a leading cause of perinatal mortality and morbidity, second only to premature birth. IUGR is also a significant risk factor for the later development of cerebral palsy, and is a greater risk compared to some of the more traditionally researched antecedents - asphyxia and inflammation. Recent evidence suggests that the white matter injury and reduced myelination in the brains of some preterm babies is due to impaired maturation of oligodendrocytes thereby resulting in the reduced capacity to synthesize myelin. Therefore, it is not surprising that the hypomyelination observable in the central nervous system of IUGR infants has similarly lead to investigations identifying a delay or blockade in the progress of maturation of oligodendrocytes in these infants. This review will discuss current ideas thought to account for the poor myelination often present in the neonate's brain following IUGR, and discuss novel interventions that are promising as treatments that promote oligodendrocyte maturation,

and thereby repair the myelination deficits that otherwise persist into infancy and childhood and lead to neurodevelopmental abnormalities.

DOI: 10.1016/j.pneurobio.2017.03.009
PMID: 28392287

Glucocorticoids Protect Neonatal Rat Brain in Model of Hypoxic-Ischemic Encephalopathy (HIE).
Harding B, Conception K, Li Y, Zhang L
Int J Mol Sci. 2016 Dec 22;18. pii: E17. doi: 10.3390/ijms18010017.

Hypoxic-ischemic encephalopathy (HIE) resulting from asphyxia in the peripartum period is the most common cause of neonatal brain damage and can result in significant neurologic sequelae, including cerebral palsy. Currently therapeutic hypothermia is the only accepted treatment in addition to supportive care for infants with HIE, however, many additional neuroprotective therapies have been investigated. Of these, glucocorticoids have previously been shown to have neuroprotective effects. HIE is also frequently compounded by infectious inflammatory processes (sepsis) and as such, the infants may be more amenable to treatment with an anti-inflammatory agent. Thus, the present study investigated dexamethasone and hydrocortisone treatment given after hypoxic-ischemic (HI) insult in neonatal rats via intracerebroventricular (ICV) injection and intranasal administration. In addition, we examined the effects of hydrocortisone treatment in HIE after lipopolysaccharide (LPS) sensitization in a model of HIE and sepsis. We found that dexamethasone significantly reduced rat brain infarction size when given after HI treatment via ICV injection; however it did not demonstrate any neuroprotective effects when given intranasally. Hydrocortisone after HI insult also significantly reduced brain infarction size when given via ICV injection; and the intranasal administration showed to be protective of brain injury in male rats at a dose of 300 µg. LPS sensitization did significantly increase the brain infarction size compared to controls, and hydrocortisone treatment after LPS sensitization showed a significant decrease in brain infarction size when given via ICV injection, as well as intranasal administration in both genders at a dose of 300 µg. To conclude, these results show that glucocorticoids have significant neuroprotective effects when given after HI injury and that these effects may be even more pronounced when given in circumstances of additional inflammatory injury, such as neonatal sepsis.
Free PMC Article
DOI: 10.3390/ijms18010017
PMCID: PMC5297652
PMID: 28025500 [Indexed for MEDLINE]
Conflict of interest statement: The authors declare no conflict of interest.

Données cliniques

Antenatal magnesium sulfate for both tocolysis and fetal neuroprotection in premature rupture of the membranes before 32 weeks' gestation.
Jung EJ, Byun JM, Kim YN, Lee KB , Sung MS, Kim KT, Shin JB, Jeong DH.
J Matern Fetal Neonatal Med. 2017 Apr 26:1-11. doi: 10.1080/14767058.2017.1317743. [Epub ahead of print]

OBJECTIVE: We aimed to assess the impact of antenatal MgSO4 therapy given to women with PPROM before 32 weeks' gestation on latency, maternal outcomes, perinatal outcomes, and neurodevelopmental outcomes.
METHODS: We undertook a retrospective cohort observational study of 184 singleton pregnancies complicated by PPROM at 23°-31(6) weeks who were hospitalized and received magnesium therapy for tocolysis (MgSO4 group) or did not receive tocolytic therapy (no MgSO4 group) between 2005 and 2013. Furthermore, patients were subdivided into two groups based on the gestational age at the onset of PPROM (23°-27(6) weeks' gestation and 28°-31(6) weeks' gestation).
RESULTS: We included 184 women, of whom 143 received magnesium therapy and 41 did not. The latency period was significantly longer in the MgSO4 group compared with no MgSO4 group (7.9 ± 9.0 versus 4.0 ± 6.0 days, p = .0017). Antenatal magnesium therapy was significantly associated with decreased stillbirth (1.4% versus 14.6%, p = .0012) and perinatal mortality (7% versus 19.5%, p = .0375) without significant increase in the risk of neonatal morbidities and chorioamnionitis. However, neonates who were exposed to antenatal MgSO4 were associated with

higher Mg levels (3.63 ± 1.05 mg/dl versus 2.13 ± 0.48 mg/dl, p < .0001) and phosphate levels (6.90 ± 1.36 mg/d versus 6.40 ± 1.01 mg/dl, p = .0459) than those who were not exposed. Neonates who were exposed to MgSO4 showed significantly reduced risks of IVH (20.4% versus 58.3%; RR, 0.35; 95%CI, 0.17-0.71) and PVL (27.8% versus 58.3%; RR, 0.48; 95%CI, 0.25-0.91) in the subgroup of 23°-27(6) weeks' gestation. And the incidence of developmental delay in the subgroup of 23°-27(6) weeks' gestation was significantly lower in the MgSO4 group (6.5% versus 36.4%; RR, 0.18; 95%CI, 0.05-0.69). However, there were no significant differences in the development of IVH, PVL, and developmental delay between the two groups for patients in the subgroup of 28°-31(6) weeks' gestation. A similar trend was observed for cerebral palsy, with 22.2% of unexposed children affected compared with only 7.0% of exposed children (RR, 0.31; 95%CI, 0.10-1.00).
CONCLUSIONS: Antenatal magnesium therapy in women with PPROM before 32 weeks' gestation could prolong latency period, allowing for corticosteroid benefit.Moreover, MgSO4 showed fetal neuroprotective effects for neonatal IVH and PVL, and for developmental delay in infancy while prolonging latency. However, these benefits were primarily limited to the subgroup of 23°-27(6) weeks' gestation and prolonged in utero exposure to MgSO4 was associated with bone mineralization in the neonates.
DOI: 10.1080/14767058.2017.1317743
PMID: 28391733

Brain Lesions in Children with Unilateral Spastic Cerebral Palsy.
Hadzagic-Catibusic F, Avdagic E, Zubcevic S, Uzicanin S.
Med Arch. 2017 Feb;71:7-11. doi: 10.5455/medarh.2017.71.7-11. Epub 2017 Feb 5.

INTRODUCTION: Unilateral spastic cerebral palsy (US CP) is the second most common subtype of cerebral palsy.
AIM: The aim of the study was to analyze neuroimaging findings in children with unilateral spastic cerebral palsy.
MATERIAL AND METHODS: The study was hospital based, which has included 106 patients with US CP (boys 72/girls 34, term 82/preterm 24). Neuroimaging findings were classified into 5 groups: Brain maldevelopment, predominant white matter injury, predominant gray matter injury, non specific findings and normal neuroimaging findings.
RESULTS: Predominant white matter lesions where the most frequent (48/106,45.28%; term 35/preterm 13), without statistically significant difference between term and preterm born children (x2=0.4357; p=0.490517). Predominant gray matter lesions had 32/106 children, 30.19%; (term 25/preterm 7, without statistically significant difference between term and preterm born children (x2=0.902; p=0.9862). Brain malformations had 10/106 children, 9.43%, and all of them were term born. Other finding had 2/106 children, 1.89%, both of them were term born. Normal neuroimaging findings were present in14/106 patients (13.21%).
CONCLUSION: Neuroimaging may help to understand morphological background of motor impairment in children with US CP. Periventricular white matter lesions were the most frequent, then gray matter lesions.
Free PMC Article
DOI: 10.5455/medarh.2017.71.7-11
PMCID: PMC5364798
PMID: 28428665
Conflict of interest statement: • Conflict of interest: none declared.

Cerebral Autoregulation, Brain Injury, and the Transitioning Premature Infant.
Vesoulis ZA, Mathur AM.
Front Pediatr. 2017 Apr 3;5:64. doi: 10.3389/fped.2017.00064. eCollection 2017.

Improvements in clinical management of the preterm infant have reduced the rates of the two most common forms of brain injury, such as severe intraventricular hemorrhage and white matter injury, both of which are contributory factors in the development of cerebral palsy. Nonetheless, they remain a persistent challenge and are associated with a significant increase in the risk of adverse neurodevelopment outcomes. Repeated episodes of ischemia-reperfusion represent a common pathway for both forms of injury, arising from discordance between systemic blood flow and the innate regulation of cerebral blood flow in the germinal matrix and periventricular white matter. Nevertheless, establishing firm hemodynamic boundaries, as a part of neuroprotective strategy, has challenged researchers. Existing measures either demonstrate inconsistent relationships with injury, as in the case of mean arterial blood pressure, or are not feasible for long-term monitoring, such as cardiac output estimated by echocardiography. These challenges have led some researchers to focus on the mechanisms that control blood flow to the brain, known as cerebrovascular autoregulation. Historically, the function of the cerebrovascular

autoregulatory system has been difficult to quantify; however, the evolution of bedside monitoring devices, particularly near-infrared spectroscopy, has enabled new insights into these mechanisms and how impairment of blood flow regulation may contribute to catastrophic injury. In this review, we first seek to examine how technological advancement has changed the assessment of cerebrovascular autoregulation in premature infants. Next, we explore how clinical factors, including hypotension, vasoactive medications, acute and chronic hypoxia, and ventilation, alter the hemodynamic state of the preterm infant. Additionally, we examine how developmentally linked or acquired dysfunction in cerebral autoregulation contributes to preterm brain injury. In conclusion, we address exciting new approaches to the measurement of autoregulation and discuss the feasibility of translation to the bedside.
DOI: 10.3389/fped.2017.00064
PMCID: PMC5377300
PMID: 28421173

Magnesium sulfate for neuroprotection in the setting of chorioamnionitis.
Edwards JM, Edwards LE, Swamy GK, Grotegut CA
J Matern Fetal Neonatal Med. 2017 Apr 11:1-8. doi: 10.1080/14767058.2017.1311312.[Epub ahead of print]

PURPOSE: We examined the effects of magnesium on premature neonatal outcomes complicated by chorioamnionitis.
MATERIALS AND METHODS: We conducted a secondary analysis of data from the BEAM Trial, an RCT to determine if antenatal magnesium decreases the incidence of CP in preterm birth. We compared the effect of magnesium sulfate by the presence or absence of chorioamnionitis. Outcomes examined include CP, IVH, NEC, BPD, and assessments of mental and motor disability. Logistic regression was used to estimate adjusted odds ratios of each outcome.
RESULTS: About 1944 women were included in this analysis of which 228 were diagnosed with chorioamnionitis. Demographic characteristics were similar between women randomized to receive magnesium or placebo. Magnesium therapy demonstrated no significant reduction in CP in the presence of chorioamnionitis (OR 0.76, CI: 0.19-2.76) but does demonstrate benefit in the absence of chorioamnionitis (OR 0.52, CI: 0.31-0.86).
CONCLUSIONS: Antenatal magnesium did not show a clear neuroprotective effect in the setting of chorioamnionitis.
DOI: 10.1080/14767058.2017.1311312
PMID: 28395549

Magnesium sulphate and perinatal mortality and morbidity in very-low-birthweight infants born between 24 and 32 weeks of gestation in Japan.
Ohhashi m, Yoshitomi T, Sumiyoshi K, Kawagoe Y, Satoh S, Sameshima H, Ikenoue T.
Eur J Obstet Gynecol Reprod Biol. 2016 Jun;201:140-5. doi:10.1016/j.ejogrb.2016.03.048. Epub 2016 Apr 11.

OBJECTIVE: Maternal exposure to magnesium sulphate has a neuroprotective effect in premature infants. This study aimed to examine this neuroprotective effect and the dose-response relationship in very-low-birthweight infants born between 24 and 32 weeks of gestation.
STUDY DESIGN: A retrospective cohort study compared the rates of mortality and brain damage between three groups: no magnesium sulphate, low-dose (<50g) magnesium sulphate and high-dose (≥50g) magnesium sulphate.
RESULTS: Japanese maternal and neonatal databases were linked using six key parameters from 2003 to 2007. Of 298,514 deliveries, 9101 were very-low-birthweight infants. Among these, full matching was possible for 5562 infants. Of the fully-matched infants, 3763 were born between 24 and 32 weeks of gestation, and 1813 (48%) were followed-up beyond 18 months. A multivariate analysis of the data, including gestational age, sex, fetal growth restriction, antenatal steroids and low pH (<7.1), showed that the low-dose group had no beneficial effects in terms of a reduction in mortality or incidence of brain damage (cerebral palsy or mental retardation). The high-dose group showed a significantly higher mortality rate [odds ratio (OR) 1.9, 95% confidence interval (CI) 1.2-2.9]. A stratified subgroup analysis of infants born between 28 and 32 weeks of gestation showed that survivors in the low-dose group had significantly lower rates of cerebral palsy (OR 0.4, 95% CI 0.2-0.98) and brain damage (OR 0.2, 95% CI 0.1-0.9), while the high-dose group did not show any significant changes.
CONCLUSION: This study found that antepartum exposure to magnesium sulphate did not reduce the infant mortality rate or influence neurological outcomes. However, among infants born between 28 and 32 weeks of gestation, rates of cerebral palsy and brain damage were found to be significantly lower among survivors in the low-dose group.

DOI: 10.1016/j.ejogrb.2016.03.048
PMID: 27131232 [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 [Indexed for MEDLINE]

Role of Antioxidants in Neonatal Hypoxic-Ischemic Brain Injury: New Therapeutic Approaches.
Arteaga O, Álvarez A, Revuelta M, Santaolalla F, Urtasun A, Hilario E
Int J Mol Sci. 2017 Jan 28;18. pii: E265. doi: 10.3390/ijms18020265.

Hypoxic-ischemic brain damage is an alarming health and economic problem in spite of the advances in neonatal care. It can cause mortality or detrimental neurological disorders such as cerebral palsy, motor impairment and cognitive deficits in neonates. When hypoxia-ischemia occurs, a multi-faceted cascade of events starts out, which can eventually cause cell death. Lower levels of oxygen due to reduced blood supply increase the production of reactive oxygen species, which leads to oxidative stress, a higher concentration of free cytosolic calcium and impaired mitochondrial function, triggering the activation of apoptotic pathways, DNA fragmentation and cell death. The high incidence of this type of lesion in newborns can be partly attributed to the fact that the developing brain is particularly vulnerable to oxidative stress. Since antioxidants can safely interact with free radicals and terminate that chain reaction before vital molecules are damaged, exogenous antioxidant therapy may have the potential to diminish cellular damage caused by hypoxia-ischemia. In this review, we focus on the neuroprotective effects of antioxidant treatments against perinatal hypoxic-ischemic brain injury, in the light of the most recent advances.
Free PMC Article
DOI: 10.3390/ijms18020265
PMCID: PMC5343801
PMID: 28134843 [Indexed for MEDLINE]

Détection – Diagnostic

Données Fondamentales

In vivo quantification of intraventricular hemorrhage in a neonatal piglet model using an EEG-layout based electrical impedance tomography array.
Tang T, Weiss MD, Borum P, Turovets S, Tucker D, Sadleir R.
Physiol Meas. 2016 Jun;37(6):751-64. doi: 10.1088/0967-3334/37/6/751. Epub 2016 May 20.

Intraventricular hemorrhage (IVH) is a common occurrence in the days immediately after premature birth. It has been correlated with outcomes such as periventricular leukomalacia (PVL), cerebral palsy and developmental delay.

The causes and evolution of IVH are unclear; it has been associated with fluctuations in blood pressure, damage to the subventricular zone and seizures. At present, ultrasound is the most commonly used method for detection of IVH, but is used retrospectively. Without the presence of adequate therapies to avert IVH, the use of a continuous monitoring technique may be somewhat moot. While treatments to mitigate the damage caused by IVH are still under development, the principal benefit of a continuous monitoring technique will be in investigations into the etiology of IVH, and its associations with periventricular injury and blood pressure fluctuations. Electrical impedance tomography (EIT) is potentially of use in this context as accumulating blood displaces higher conductivity cerebrospinal fluid (CSF) in the ventricles. We devised an electrode array and EIT measurement strategy that performed well in detection of simulated ventricular blood in computer models and phantom studies. In this study we describe results of pilot in vivo experiments on neonatal piglets, and show that EIT has high sensitivity and specificity to small quantities of blood (<1 ml) introduced into the ventricle. EIT images were processed to an index representing the quantity of accumulated blood (the 'quantity index', QI). We found that QI values were linearly related to fluid quantity, and that the slope of the curve was consistent between measurements on different subjects. Linear discriminant analysis showed a false positive rate of 0%, and receiver operator characteristic analysis found area under curve values greater than 0.98 to administered volumes between 0.5, and 2.0 ml. We believe our study indicates that this method may be well suited to quantitative monitoring of IVH in newborns, simultaneously or interleaved with electroencephalograph assessments.

Free PMC Article

DOI: 10.1088/0967-3334/37/6/751
PMCID: PMC5333710
PMID: 27206102 [Indexed for MEDLINE]

Données cliniques

Analysis of antenatal-onset cerebral palsy secondary to transient ischemia in utero using a national database in Japan.

Fukushima K, Morokuma S, Kitadai Y, Tazaki Y, Sumie M, Nakanami N, Ushiro S, Matsuda Y, Tsukimori K

J Obstet Gynaecol Res. 2016 Oct;42(10):1297-1303. doi: 10.1111/jog.13046. Epub 2016 Jun 8.

AIM: We conducted a retrospective analysis of summary medical reports of children diagnosed with cerebral palsy (CP) to identify clinical features of antenatal onset of CP secondary to transient ischemia in utero.
METHODS: The 658 brief summary reports available in the Japan Obstetric Compensation System for Cerebral Palsy were screened, and we identified cases of singleton pregnancy, delivered at gestational age ≥ 33 weeks and those with cord blood gas pH ≥ 7.20. Of the 137 cases identified, 84 were excluded for the following reasons: no evidence of ischemic brain lesion, clear post-natal causative factor of CP, presence of a congenital condition, and sentinel hypoxic event, such as uterine rupture. The demographic profiles of the 53 cases included in our analysis were compared to identify those with and without an abnormal variability in fetal heart rate.
RESULTS: Between-group comparison identified an association between abnormal heart rate variability and a lower Apgar score at 1 min (2 vs 6; P < 0.001) and 5 min (5.5 vs 8; P = 0.002), and more frequent episodes of fetal movement loss (41% vs 10%; P = 0.027). An hypoxic event ≤ 1 week before delivery was more likely to be associated with abnormal heart rate variability (89%) and low Apgar score (82%), while events at > 1 week were associated with development of polyhydramnios (44%).
CONCLUSION: In utero transient ischemic events can contribute to term or near-term CP. Careful follow-up is recommended for fetuses with a history of fetal movement loss, abnormal variability in heart rate, and polyhydramnios of unknown causes.

DOI: 10.1111/jog.13046
PMID: 27279463 [Indexed for MEDLINE]

Cranial ultrasound findings in preterm infants predict the development of cerebral palsy.

Skovgaard AL, Zachariassen G.

Dan Med J. 2017 Feb;64(2). pii: A5330.

INTRODUCTION: Our aim was to evaluate any association between gestational age, birth weight and findings on cranial ultrasounds during hospitalisation in very preterm infants and mortality and neurological outcome in childhood.
METHOD: This study was a retrospective cohort study based on a patient record review. The cohort consisted of very preterm born children (gestational age ≤ 32 + 0) born from 2004 to 2008. For each infant, we obtained results from all cranial ultrasounds performed during hospitalisation. In 2014, patient records were evaluated for cerebral palsy, Gross Motor Function Classification System, blindness and deafness.
RESULTS: A total of 249 infants were included. The mortality rate was 9.2%. In all, 217 children were evaluated at 5-9 years of age. Four children were diagnosed with germinal matrix haemorrhage - intraventricular haemorrhage grade 3 (GMH-IVH3) and periventricular haemorrhagic infarction (PVHI), of whom two developed cerebral palsy. Nine children were diagnosed with periventricular leukomalacia (PVL), of whom six developed cerebral palsy. Cerebral palsy was detected in 14 children (6.4%), and one (0.5%) child was in need of a hearing assistive device. Severe brain injury (GMH-IVH3, PVHI or PVL) (p = 0.000) and being of male gender (p = 0.03) were associated with cerebral palsy in childhood.
CONCLUSION: Severe brain injuries detected by neonatal cranial ultrasound in very preterm infants is associated with development of cerebral palsy in childhood.
FUNDING: none. TRAIL REGISTRATION: not relevant.
PMID: 28157062 [Indexed for MEDLINE]

Early identification of motor delay: Family-centred screening tool.
Harris SR
Can Fam Physician. 2016 Aug;62(8):629-32.

OBJECTIVE: To describe the Harris Infant Neuromotor Test (HINT), an infant neuromotor test using Canadian norms published in 2010 that could be used to screen for motor delay during the first year of life.
QUALITY OF EVIDENCE: Extensive research has been published on the intrarater, interrater, and test-retest reliability and the content, concurrent, predictive, and known-groups validity of the HINT, as well as on the sensitivity, specificity, and positive and negative predictive values of parental concerns, as assessed by the HINT. Most evidence is level II.
MAIN MESSAGE: Diagnosing motor delays during the first year of life is important because these often indicate more generalized developmental delays or specific disabilities, such as cerebral palsy. Parental concerns about their children's motor development are strongly predictive of subsequent diagnoses involving motor delay.
CONCLUSION: Only through early identification of developmental motor delays, initially with screening tools such as the HINT, is it possible to provide referrals for early intervention that could benefit both the infant and the family.

PMCID: PMC4982721

Formal training in general movement assessment is required to effectively evaluate infants with perinatal asphyxia in outpatient settings.
Brown AK, Greisen G, Haugsted U, Jonsbo F
Acta Paediatr. 2016 Sep;105(9):1056-60. doi: 10.1111/apa.13491. Epub 2016 Jun 24.

AIM: General movement assessment (GMA) can help to identify children with a high risk of developing neurological dysfunction, such as cerebral palsy, and certified training is provided in this specialism. The aim of this study was to investigate the feasibility and reliability of using video recordings to assess GMA, in a busy Danish outpatient clinic.
METHODS: The study comprised 30-term infants born with perinatal asphyxia, who were video recorded at three months. They were assessed by two certified GMA observers and re-assessed two weeks later. Interobserver and intra-observer agreements were analysed using proportional agreement, and nominal kappa statistics were used to calculate 95% confidence intervals (95% CI).
RESULTS: We found substantial and almost perfect interobserver and intra-observer reliability. Intra-observer agreement was 0.85 (95% CI: 0.65-1.00; p < 0.0001) and 0.85 (95% CI: 0.62-1.00; p < 0.0001), and interobserver agreement was 0.71 (95% CI: 0.45-0.96; p < 0.0001) at time point one and 0.85 (95% CI: 0.63-1.00; p < 0.0001) two weeks later. All video recordings were completed within our multidisciplinary outpatient clinic without delay.

CONCLUSION: This study demonstrated the reliability of the GMA method in a busy multidisciplinary Danish paediatric outpatient setting, when assessors had been formally trained in the method and used it regularly.

DOI: 10.1111/apa.13491
PMID: 27240948 [Indexed for MEDLINE]

Fidgety movements - tiny in appearance, but huge in impact.
Einspieler C, Peharz R(Marschik PB
J Pediatr (Rio J). 2016 May-Jun;92(3 Suppl 1):S64-70. doi: 10.1016/j.jped.2015.12.003. Epub 2016 Mar 17.

OBJECTIVES: To describe fidgety movements (FMs), i.e., the spontaneous movement pattern that typically occurs at 3-5 months after term age, and discuss its clinical relevance.
SOURCES: A comprehensive literature search was performed using the following databases: MEDLINE/PubMed, CINAHL, The Cochrane Library, Science Direct, PsycINFO, and EMBASE. The search strategy included the MeSH terms and search strings ('fidgety movement*') OR [('general movement*') AND ('three month*') OR ('3 month*')], as well as studies published on the General Movements Trust website (www.general-movements-trust.info).
SUMMARY OF THE DATA: Virtually all infants develop normally if FMs are present and normal, even if their brain ultrasound findings and/or clinical histories indicate a disposition to later neurological deficits. Conversely, almost all infants who never develop FMs have a high risk for neurological deficits such as cerebral palsy, and for genetic disorders with a late onset. If FMs are normal but concurrent postural patterns are not age-adequate or the overall movement character is monotonous, cognitive and/or language skills at school age will be suboptimal. Abnormal FMs are unspecific and have a low predictive power, but occur exceedingly in infants later diagnosed with autism.
CONCLUSIONS: Abnormal, absent, or sporadic FMs indicate an increased risk for later neurological dysfunction, whereas normal FMs are highly predictive of normal development, especially if they co-occur with other smooth and fluent movements. Early recognition of neurological signs facilitates early intervention. It is important to re-assure parents of infants with clinical risk factors that the neurological outcome will be adequate if FMs develop normally.
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DOI: 10.1016/j.jped.2015.12.003
PMID: 26997356 [Indexed for MEDLINE]

Motor trajectories from birth to 5 years of children born at less than 30 weeks' gestation: early predictors and functional implications. Protocol for a prospective cohort study.
Spittle AJ, McGinley JL, Thompson D, Clark R, FitzGerald TL, Mentiplay BF, Lee KJ, Olsen JE, Burnett A, Treyvaud K, Josev E, Alexander B, Kelly CE, Doyle LW, Anderson PJ, Cheong JL
J Physiother. 2016 Oct;62(4):222-3. doi: 10.1016/j.jphys.2016.07.002. Epub 2016 Aug 5.

INTRODUCTION: Motor impairments are one of the most frequently reported adverse neurodevelopmental consequences in children born < 30 weeks' gestation. Up to 15% of children born at < 30 weeks have cerebral palsy and an additional 50% have mild to severe motor impairment at school age. The first 5 years of life are critical for the development of fundamental motor skills. These skills form the basis for more complex skills that are required to competently and confidently participate in schooling, sporting and recreational activities. In children born at < 30 weeks' gestation, the trajectory of motor development from birth to 5 years is not fully understood. The neural alterations that underpin motor impairments in these children are also unclear. It is essential to determine if early clinical evaluations and neuroimaging biomarkers can predict later motor impairment and associated functional problems at 5 years of age. This will help to identify children who will benefit the most from early intervention and improve functional outcomes at school age.
RESEARCH AIMS: The primary aim of this study is to compare the prevalence of motor impairment from birth to 5 years of age between children born at < 30 weeks and term-born controls, and to determine whether persistent abnormal motor assessments in the newborn period in those born at < 30 weeks predict abnormal motor functioning at 5 years of age. Secondary aims for children born at < 30 weeks and term-born children are: 1) to determine whether novel early magnetic resonance imaging-based structural or functional biomarkers that can predict motor impairments at 5 years are detectable in the neonatal period; 2) to investigate the association between motor impairments and concurrent deficits in body structure and function at 5 years of age; and 3) to

explore how motor impairments at 5 years (including abnormalities of gait, postural control and strength) are associated with concurrent functional outcomes, including physical activity, cognitive ability, learning ability, and behavioural and emotional problems.
DESIGN: Prospective longitudinal cohort study.
PARTICIPANTS AND SETTING: 150 preterm children (born at < 30 weeks' gestation) and 151 term-born children (born at > 36 completed weeks' gestation and weighing > 2499g) admitted to the Royal Women's Hospital, Melbourne, were recruited at birth and will be invited to participate in a 5-year follow-up study.
PROCEDURE: This study will examine previously collected data (from birth to 2 years) that comprise detailed motor assessments, and structural and functional brain MRI images. At 5 years, preterm and term, children will be examined using comprehensive motor assessments, including: the Movement Assessment Battery for Children (2nd edition) and measures of gait function through spatiotemporal (assessed with the GAITRite® Walkway) and dynamic postural control (assessed with Microsoft Kinect) variables; and hand grip strength (assessed with a dynamometer); and measures of physical activity (assessed using accelerometry), cognitive development (assessed with Wechsler Preschool and Primary Scale of Intelligence), and emotional and behavioural status (assessed with the Strengths and Difficulties Questionnaire and the Developmental and Wellbeing Assessment). At the 5-year assessment, parents/caregivers will be asked to complete questionnaires on demographics, physical activity, activities of daily living, behaviour, additional therapy (eg, physiotherapy and occupational therapy), and motor function (assessed with Pediatric Evaluation of Disability Inventory, Pediatric Quality of Life Questionnaire, the Little Developmental Co-ordination Questionnaire and an activity diary).
ANALYSIS: For the primary aim, the prevalence of motor impairment from birth to 5 years will be compared between children born at < 30 weeks and at term, using the proportion of children classified as abnormal at each of the time points (term age, 1, 2 and 5 years). Persistent motor impairments during the neonatal period will be assessed as a predictor of severity of motor impairment at 5 years of age in children born < 30 weeks using linear regression. Models will be fitted using generalised estimating equations to allow for the clustering of multiple births. Analysis will be repeated with adjustment for predictors of motor outcome, including additional therapy, sex, brain injury and chronic lung disease.
DISCUSSION/SIGNIFICANCE: Understanding the developmental precursors of motor impairment in children born before 30 weeks is essential for limiting disruption to skill development, and potential secondary impacts on physical activity, participation, academic achievement, self-esteem and associated outcomes (such as obesity, poor physical fitness and social isolation). An improved understanding of motor skill development will enable targeting of interventions and streamlining of services to children at highest risk of motor impairments.

Free Article
DOI: 10.1016/j.jphys.2016.07.002
PMID: 27634166 [Indexed for MEDLINE]

Motricité - Mobilité – Posture

Accuracy and Reliability of Marker Based Approaches to Scale the Pelvis, Thighand Shank Segments in Musculoskeletal Models.
Kainz H, Hoang H, Stockton C, Boyd RR, Lloyd DG,Carty CP
J Appl Biomech. 2017 Mar 14:1-21. doi: 10.1123/jab.2016-0282. [Epub ahead ofprint]

Gait analysis together with musculoskeletal modelling is widely used for research. In the absence of medical images, surface marker locations are used to scale a generic model to the individual's anthropometry. Studies evaluating the accuracy and reliability of different scaling approaches in a paediatric and/or clinical population have not yet been conducted and, therefore, formed the aim of this study. Magnetic resonance images (MRI) and motion capture data were collected from twelve participants with cerebral palsy and six typically developed participants. Accuracy was assessed by comparing the scaled model's segments measures to the corresponding MRI measures, whereas reliability was assessed by comparing the model's segments scaled with the experimental marker locations from the first and second motion capture session. The inclusion of joint centres into the scaling process significantly increased the accuracy of thigh and shank segment length estimates compared to scaling with markers alone. Pelvis scaling approaches which included the pelvis depth measure led to the highest errors compared to the MRI measures.

Reliability was similar between scaling approaches with mean ICC of 0.97. Pelvis should be scaled using pelvic width and height and the thigh and shank segment should be scaled using the proximal and distal joint centres.
DOI: 10.1123/jab.2016-0282
PMID: 28290736

Assessment of anthropometric indicators in children with cerebral palsy according to the type of motor dysfunction and reference standard.
García Iñiguez JA, Vásquez-Garibay EM, García Contreras A, Romero-Velarde E, Troyo Sanromán R.
Nutr Hosp. 2017 Mar 30;34(2):315-322. doi: 10.20960/nh.353.

AIM: The study aimed to demonstrate that the assessment of the anthropomorphic measurements of children with cerebral palsy (CP) varies according to the type of motor dysfunction and references standard used for comparison.
METHOD: In a cross-sectional design, 108 children 2 to 16 years were classified according to the type of motor dysfunction by gender and age group. Weight, mid-upper-arm-circumference (MUAC), and alternative measures for height were performed. Height/age and weight/age indexes and BMI were evaluated with percentiles and/or Z-scores with reference to a number of previously published references of growth, including those of the World Health Organization (WHO).
RESULTS: Fifty-three (49.1%) were females and 55 (50.9%) males. Spastic type was predominant (73.1%) and 26.9% were other types of dysfunction. Most of the children were located on level IV (14.6%) and level V (73.1%) of the Gross Motor Function Classification System (GMFCS). Significant differences were found, suggesting that weight (p = 0.002), height (p = 0.001), and MUAC (p = 0.05) are higher in the spastic group than in other groups.
CONCLUSIONS: The anthropometric indicators were significantly higher in the spastic group than in other groups. Upper-arm length (UAL) seemed less appropriate than knee height (KH) and lower-leg length (LLL) for measuring height. The WHO reference standard was not useful to evaluate the majority of anthropometric indexes in children with CP, other references as the growth charts
of Day and Brooks have been more suitable.
Free Article
PMID: 28421784

Assessment of Upper Limb Motor Dysfunction for Children with Cerebral Palsy Based on Muscle Synergy Analysis.
Tang L, Chen X, Cao S, Wu, Zhao G, Zhang X.
Front Hum Neurosci. 2017 Mar 23;11:130. doi: 10.3389/fnhum.2017.00130. eCollection 2017.

Muscle synergies are considered to be building blocks underlying motor behaviors. The goal of this study is to explore an objective and effective method to assess the upper limb motor dysfunction of cerebral palsy (CP) children from the aspect of muscle synergy analysis. Fourteen CP children and 10 typically developed (TD) children were recruited to perform three similar upper limb motion tasks related to the movements of elbow and shoulder joints, and surface electromyographic (sEMG) signals were recorded from 10 upper arm and shoulder muscles involved in the defined tasks. Non-negative matrix factorization algorithm was used to extract muscle synergies and the corresponding activation patterns during three similar tasks. For each subject in TD group, four muscle synergies were extracted in each task. Whereas, fewer mature synergies were recruited in CP group, and many abnormal synergy structures specific to CP group appeared. In view of neuromuscular control strategy differences, three synergy-related parameters were proposed and synergy structure similarity coefficient was found to have high ability in depicting the inter-subject similarity within task and the intra-subject similarity between tasks. Seven upper limb assessment (UPA) metrics, which were defined as the combinations of synergy structure similarity coefficients of three tasks, were proposed to assess the upper limb motor function of CP children. The experimental results demonstrated that these UPA metrics were able to assess upper limb motor function comprehensively and effectively. The proposed assessment method can serve as a promising approach to quantify the abnormality of muscle synergies, thus offering potential to derive a physiologically based quantitative index for assessing upper limb motor function in CP clinical diagnosis and rehabilitation.
Free PMC Article
DOI: 10.3389/fnhum.2017.00130
PMCID: PMC5362624
PMID: 28386223

Characterisation of the patellar tendon reflex in cerebral palsy children using motion analysis.
O'Sullivan R, Kiernan d, Walsh M, O'Brien T, Elhassan Y.
Ir J Med Sci. 2016 Nov;185(4):813-817. Epub 2015 Oct 15.

BACKGROUND: The patellar tendon reflex (PTR) is an important spinal reflex and an important diagnostic tool assessing neurological disturbances. Reflexes are conveniently assessed but quantifying the response can be subjective. Motion analysis is commonly used to assess gait kinematics in a variety of populations. It can be used to objectively assess the PTR with the advantage that standard technique and hammer can be used without the need for bulky apparatus or fixing the subject position.
AIM: To compare the PTR in 15 cerebral palsy (CP) children with age and height matched controls.
METHODS: EMG reflex latency in the rectus femoris was assessed using a Noraxon 2400T unit. Knee movement latency, knee angular displacement and peak angular velocity were captured using the CODA mpx 30 system.
RESULTS: EMG reflex latency was significantly reduced in CP compared to control limbs (13.11 versus 18.11 ms; $p < 0.01$) confirming a 'brisk' response in this population. The kinematic data found that while knee angular displacement was significantly reduced in CP (12.82° versus 20.06°; $p < 0.01$) there was no significant difference in movement latency or peak angular velocity compared to controls.
CONCLUSIONS: Subjective evaluation of the PTR relies mostly on change in knee angle. Using motion analysis we have confirmed a difference in this variable in CP compared to controls. We have also shown reduced reflex latency associated with a brisk reflex. Knee movement latency and peak angular velocity did not differentiate CP from normal. Further examination of the knee angular response of the PTR is warranted in CP.
DOI: 10.1007/s11845-015-1369-3
PMID: 26472096 [Indexed for MEDLINE]

Construct validity and responsiveness of Movakic: An instrument for the evaluation of motor abilities in children with severe multiple disabilities.
Mensch SM, Echteld MA, Evenhuis HM, Rameckers EA
Res Dev Disabil. 2016 Dec;59:194-201. doi: 10.1016/j.ridd.2016.08.012. Epub 2016 Sep 12.

Movakic is a newly developed instrument for measurement of motor abilities in children with severe multiple disabilities, with a satisfactory feasibility and content validity and good inter-observer and test-retest reliability. The objective of this study was to investigate its construct validity and responsiveness to change. Sixty children with severe multiple disabilities (mean age 7.7 years, range 2-16) were measured using Movakic six times during 18 months. Construct validity was assessed by correlating Movakic scores with expert judgment. In order to assess responsiveness, scores during 3-months intervals were compared (mean score-changes and intraclass correlations) during which some children experienced meaningful events influencing motor abilities and during which others experienced no such event. Forty-five percent of children had a lower cognitive development level than 6-month, 52% had Gross Motor Function Classification System level V and 37% had level IV. For 27 children all measurements were completed, six children dropped out. Construct validity was good (r=0.50-0.71). Responsiveness was demonstrated by significantly larger score changes after events than when such events did not occur. Movakic is a valid instrument for measuring motor abilities in children with severe multiple disabilities. Results suggest responsiveness to change in motor abilities after meaningful events.

DOI: 10.1016/j.ridd.2016.08.012
PMID: 27627682 [Indexed for MEDLINE]

Evaluating the Discriminant Validity of the Pediatric Evaluation of Disability Inventory: Computer Adaptive Test in Children With Cerebral Palsy.
Shore BJ, Allar BG, Miller PE, Matheney TH, Snyder BD, Fragala-Pinkham MA.
Phys Ther. 2017 Mar 31. doi: 10.1093/ptj/pzx033. [Epub ahead of print]

Background: The PEDI-CAT is a new clinical assessment for children and youth from birth through 20 years of age.
Objective: To determine the discriminant validity of the PEDI-CAT according to Gross Motor Function Classification System (GMFCS) and Manual Ability
Classification System (MACS) in children with cerebral palsy (CP).

Design: A prospective convenience cross-sectional sample of 101 school-aged children with CP was stratified by GMFCS level.
Methods: Participants were excluded if they underwent recent surgery (<6 months). Receiver operator curve analysis was used to quantify the discriminant validity of the PEDI-CAT domains to distinguish level of independence in fine and gross motor function. General linear modeling was used to assess discriminant ability across all GMFCS and MACS levels.
Results: Mean age was 11 years, 11 months (SD 3.7). Mobility and Daily Activities domains exhibited excellent discriminant validity distinguishing between ambulatory and non-ambulatory participants (AUC = 0.98 and 0.97, respectively) and Daily Activities domain exhibited excellent discriminant validity distinguishing between independent and dependent hand function (AUC = 0.93). All PEDI-CAT domains were able to discriminate between ambulatory (GMFCS level I-III) or non-ambulatory (GMFCS level IV-V) as well as manually independent (MACS level I-II) or manually dependent functional levels (MACS level III-V) ($p<0.001$). Limitations: Our convenience-cross sectional sample included school age children with primarily Caucasian, middle-income parents and may not be representative of other cultural, socio-economic backgrounds. Not all participants had a MACS level assigned; however, we found no 5. J Pediatr Orthop. 2016 Dec;36(8):829-833. differences in PEDI-CAT scores between those with and without MACS scores. Conclusions: These results demonstrate that the PEDI-CAT is a valid outcome instrument for measuring functional abilities in children with CP, able to differentiate across fine and gross motor functional levels.
DOI: 10.1093/ptj/pzx033
PMID: 28379484

Functional status and amount of hip displacement independently affect acetabular dysplasia in cerebral palsy.
Chung MK, Zulkarnain A, Lee JB, Cho BC, Chung CY, Lee KM, Sung KH, Park MS.
Dev Med Child Neurol. 2017 Apr 22. doi: 10.1111/dmcn.13437. [Epub ahead of print]

AIM: Acetabular dysplasia is the one of main causes of hip displacement in patients with cerebral palsy (CP). Although several studies have shown a relationship between hip displacement and acetabular dysplasia, relatively few have evaluated the association between quantitative acetabular dysplasia and related factors, such as Gross Motor Function Classification System (GMFCS) level.
METHOD: We performed a morphometric analysis of the acetabulum in patients with CP using multiplanar reformation of computed tomography data. The three directional acetabular indices (anterosuperior, superolateral, and posterosuperior) were used to evaluate acetabular dysplasia. Consequently, linear mixed-effects models were used to adjust for related factors such as age, sex, GMFCS level, and migration percentage.
RESULTS: A total of 176 patients (mean age 9y 5mo, range 2y 4mo-19y 6mo; 104 males, 72 females) with CP and 55 typically developing individuals (mean age 13y 6mo, range 2y 5mo-19y 10mo; 37 males, 18 females) in a comparison group were enrolled in this study. Statistical modelling showed that all three directional acetabular indices independently increased with GMFCS level ($p<0.001$) and migration percentage ($p<0.001$).
INTERPRETATION: Acetabular dysplasia was independently affected by both the amount of hip displacement and the GMFCS level. Thus, physicians should consider not only the migration percentage but also three-dimensional evaluation in patients at high GMFCS levels.

DOI: 10.1111/dmcn.13437
PMID: 28432692

Kinematic gait pattern in children with cerebral palsy and leg length discrepancy: Effects of an extra sole.
Eek MN, Zügner R, Stefansdottir I, Tranberg R.
Gait Posture. 2017 Jun;55:150-156. doi: 10.1016/j.gaitpost.2017.04.022. Epub 2017 Apr 17.

The gait pattern in children with cerebral palsy (CP) often differs from normal, with slow velocity, problem with foot clearance and increased stress on joints. Several factors, such as muscle tone, impaired motor control, muscle contractures, skeletal deformities and leg length discrepancy affect gait. Leg length discrepancy can be treated surgically or with elevation of the shoe on the short leg. The purpose of this study was to examine whether compensating for leg length discrepancy, with elevation of the sole, leads to a change in movement pattern during walking in children with spastic CP.RESULTS: Ten children with spastic CP, able to walk without aids, and 10 typically developing (TD) children aged between seven and 14 years were assessed with 3D gait analysis: 1) barefoot, 2) with

shoes and 3) with an extra sole beneath the shoe for the shorter leg. All children with CP had a leg length discrepancy of more than or equal to 1.0cm. In the barefoot condition, the velocity was slower and the stride length was shorter, in children with CP compared with TD. The stride length and gait velocity increased in children with CP with shoes and shoe+sole and the stance time became more symmetrical. Among children with CP, there was more flexion in the longer leg relative to the short leg during barefoot walking. Differences in the kinematic pattern between the long and the short leg decreased with the extra sole.

DOI: 10.1016/j.gaitpost.2017.04.022
PMID: 28448898

Medial gastrocnemius and soleus muscle-tendon unit, fascicle, and tendon interaction during walking in children with cerebral palsy.
Dev Med Child Neurol. 2017 Apr 1. doi: 10.1111/dmcn.13427. [Epub ahead of print]
Barber L, Carty C, Modenese L, Walsh J, Boyd R, Lichtwark G.

AIM: This study investigates the in vivo function of the medial gastrocnemius and soleus muscle-tendon units (MTU), fascicles, and tendons during walking in children with cerebral palsy (CP) and an equinus gait pattern.
METHOD: Fourteen children with CP (9 males, 5 females; mean age 10y 6mo, standard deviation [SD] 2y 11mo; GMFCS level I=8, II=6), and 10 typically developing (6 males, 4 females; mean age 10y, SD 2y 1mo) undertook full body 3D gait analysis and simultaneous B-mode ultrasound images of the medial gastrocnemius and soleus fascicles during level walking. Fascicle lengths were analysed using a semi-automated tracking algorithm and MTUs using OpenSim. Statistical parametric mapping (two-sample t-test) was used to compare differences between groups ($p<0.05$).
RESULTS: In the CP group medial gastrocnemius fascicles lengthened during mid-stance gait and remained longer into late-stance compared to the typically developing group ($p<0.001$). CP medial gastrocnemius fascicles shortened less during stance (1.16mm [SD 1.47mm]) compared to the typically developing group (4.48mm [SD 1.94mm], $p<0.001$). In the CP group the medial gastrocnemius and soleus MTU and tendon were longer during early- and mid-stance ($p<0.001$). Ankle power during push-off ($p=0.015$) and positive work ($p<0.002$) and net work ($p<0.001$) were significantly lower in the CP group.
INTERPRETATION: Eccentric action of the CP medial gastrocnemius muscle fascicles during mid-stance walking is consistent with reduced volume and neuromuscular control of impaired muscle. Reduced ankle push-off power and positive work in the children with CP may be attributed to reduced active medial gastrocnemius fascicle shortening. These findings suggest a reliance on passive force generation for forward propulsion during equinus gait.

DOI: 10.1111/dmcn.13427
PMID: 28369824

Neurologic Correlates of Gait Abnormalities in Cerebral Palsy: Implications for Treatment.
Zhou J, Butler EE, Rose J.
Front Hum Neurosci. 2017 Mar 17;11:103. doi: 10.3389/fnhum.2017.00103. eCollection 2017.

Cerebral palsy (CP) is the most common movement disorder in children. A diagnosis of CP is often made based on abnormal muscle tone or posture, a delay in reaching motor milestones, or the presence of gait abnormalities in young children. Neuroimaging of high-risk neonates and of children diagnosed with CP have identified patterns of neurologic injury associated with CP, however, the neural underpinnings of common gait abnormalities remain largely uncharacterized. Here, we review the nature of the brain injury in CP, as well as the neuromuscular deficits and subsequent gait abnormalities common among children with CP. We first discuss brain injury in terms of mechanism, pattern, and time of injury during the prenatal, perinatal, or postnatal period in preterm and term-born children. Second, we outline neuromuscular deficits of CP with a focus on spastic CP, characterized by muscle weakness, shortened muscle-tendon unit, spasticity, and impaired selective motor control, on both a microscopic and functional level. Third, we examine the influence of neuromuscular deficits on gait abnormalities in CP, while considering emerging information on neural correlates of gait abnormalities and the implications for strategic treatment. This review of the neural basis of gait abnormalities in CP discusses what is known about links between the location and extent of brain injury and the type and severity of CP, in relation to the associated neuromuscular deficits, and subsequent gait abnormalities. Targeted treatment opportunities are identified that may improve

functional outcomes for children with CP. By providing this context on the neural basis of gait abnormalities in CP, we hope to highlight areas of further research that can reduce the long-term, debilitating effects of CP.
Free PMC Article
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PMCID: PMC5355477
PMID: 28367118

Outcome measures evaluating hand function in children with bilateral cerebral palsy: a systematic review.
Elvrum AK, Saether R, Riphagen II, Vik T.
Dev Med Child Neurol. 2016 Jul;58(7):662-71. doi: 10.1111/dmcn.13119. Epub 2016 Apr 28.

AIM: To review outcome measures used to evaluate hand function, with emphasis on manual capacity and performance, in children with bilateral cerebral palsy (CP), to describe the content and measurement properties of such measures, and to investigate the quality of the studies that have examined these properties.
METHOD: Embase, MEDLINE, PubMed, and CINAHL were searched. The COSMIN-criteria (COnsensus-based Standards for the selection of health Measurement INstruments) were used to assess the quality of studies and the Terwee criteria were used to assess the result of the studies.
RESULTS: Five hand function measures were identified from 16 papers. The strongest level of evidence for aspects of validity and reliability was found for the Melbourne Assessment 2, assessing unimanual capacity, and for the questionnaire ABILHAND-Kids, assessing perceived manual ability in daily activities. However, evidence for the responsiveness of these measures is missing.
INTERPRETATION: Further high-quality studies providing evidence for responsiveness, as well as for additional aspects of validity and reliability of the Melbourne Assessment 2 and the ABILHAND-Kids, are needed. Furthermore, there is a need to develop appropriate outcome measures evaluating how children with bilateral CP use their hands when handling objects in bimanual tasks.

DOI: 10.1111/dmcn.13119
PMID: 27121675 [Indexed for MEDLINE]

Overview of Four Functional Classification Systems Commonly Used in Cerebral Palsy.
Paulson A, Vargus-Adams J.
Children (Basel). 2017 Apr 24;4. pii: E30. doi: 10.3390/children4040030.

Cerebral palsy (CP) is the most common physical disability in childhood. CP comprises a heterogeneous group of disorders that can result in spasticity, dystonia, muscle contractures, weakness and coordination difficulty that ultimately affects the ability to control movements. Traditionally, CP has been classified using a combination of the motor type and the topographical distribution, as well as subjective severity level. Imprecise terms such as these tell very little about what a person is able to do functionally and can impair clear communication between providers. More recently, classification systems have been created employing a simple ordinal grading system of functional performance. These systems allow a more precise discussion between providers, as well as better subject stratification for research. The goal of this review is to describe four common functional classification systems for cerebral palsy: the Gross Motor Function Classification System (GMFCS), the Manual Ability Classification System (MACS), the Communication Function Classification System (CFCS), and the Eating and Drinking Ability Classification System (EDACS). These measures are all standardized, reliable, and complementary to one another.
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PMCID: PMC5406689
PMID: 28441773

[**Palsy of the upper limb: Obstetrical brachial plexus palsy, arthrogryposis, cerebral palsy**]. [Article in French]
Salazard B, Philandrianos C, Tekpa B.
Ann Chir Plast Esthet. 2016 Oct;61(5):613-621. doi: 10.1016/j.anplas.2016.09.003. Epub 2016 Sep 28.

"Palsy of the upper limb" in children includes various diseases which leads to hypomobility of the member: cerebral palsy, arthrogryposis and obstetrical brachial plexus palsy. These pathologies which differ on brain damage or not, have the same consequences due to the early achievement: negligence, stiffness and deformities. Regular entire

clinical examination of the member, an assessment of needs in daily life, knowledge of the social and family environment, are key points for management. In these pathologies, the rehabilitation is an emergency, which began at birth and intensively. Splints and physiotherapy are part of the treatment. Surgery may have a functional goal, hygienic or aesthetic in different situations. The main goals of surgery are to treat: joints stiffness, bones deformities, muscles contractures and spasticity, paresis, ligamentous laxity.
DOI: 10.1016/j.anplas.2016.09.003
PMID: 27692236 [Indexed for MEDLINE]

Reliability of four models for clinical gait analysis.
Kainz H, Graham D, Edwards J, Walsh HPJ, Maine S, Boyd RN, Lloyd DG, Modenese L, Carty CP.
Gait Posture. 2017 Apr 3;54:325-331. doi: 10.1016/j.gaitpost.2017.04.001. [Epubahead of print]

Three-dimensional gait analysis (3DGA) has become a common clinical tool for treatment planning in children with cerebral palsy (CP). Many clinical gait laboratories use the conventional gait analysis model (e.g. Plug-in-Gait model), which uses Direct Kinematics (DK) for joint kinematic calculations, whereas, musculoskeletal models, mainly used for research, use Inverse Kinematics (IK). Musculoskeletal IK models have the advantage of enabling additional analyses which might improve the clinical decision-making in children with CP. Before any new model can be used in a clinical setting, its reliability has to be evaluated and compared to a commonly used clinical gait model (e.g. Plug-in-Gait model) which was the purpose of this study. Two testers performed 3DGA in eleven CP and seven typically developing participants on two occasions. Intra- and inter-tester standard deviations (SD) and standard error of measurement (SEM) were used to compare the reliability of two DK models (Plug-in-Gait and a six degrees-of-freedom model solved using Vicon software) and two IK models (two modifications of 'gait2392' solved using OpenSim). All models showed good reliability (mean SEM of 3.0° over all analysed models and joint angles). Variations in joint kinetics were less in typically developed than in CP participants. The modified 'gait2392' model which included all the joint rotations commonly reported in clinical 3DGA, showed reasonable reliable joint kinematic and kinetic estimates, and allows additional musculoskeletal analysis on surgically adjustable parameters, e.g. muscle-tendon lengths, and, therefore, is a suitable model for clinical gait analysis.

DOI: 10.1016/j.gaitpost.2017.04.001
PMID: 28411552

Risk Factors for Developing Scoliosis in Cerebral Palsy: A Cross-SectionalDescriptive Study.
Bertoncelli CM, Solla F, Loughenbury PR, Tsirikos AI, BertoncelliD, Rampal V.
J Child Neurol. 2017 Jun;32(7):657-662. doi: 10.1177/0883073817701047. Epub 2017 Apr 10

This study aims to identify the risk factors leading to the development of severe scoliosis among children with cerebral palsy. A cross-sectional descriptive study of 70 children (aged 12-18 years) with severe spastic and/or dystonic cerebral palsy treated in a single specialist unit is described. Statistical analysis included Fisher exact test and logistic regression analysis to identify risk factors. Severe scoliosis is more likely to occur in patients with intractable epilepsy (P = .008), poor gross motor functional assessment scores (P = .018), limb spasticity (P = .045), a history of previous hip surgery (P = .048), and nonambulatory patients (P = .013). Logistic regression model confirms the major risk factors are previous hip surgery (P = .001), moderate to severe epilepsy (P = .007), and female gender (P = .03). History of previous hip surgery, intractable epilepsy, and female gender are predictors of developing severe scoliosis in children with cerebral palsy. This knowledge should aid in the early diagnosis of scoliosis and timely referral to specialist services.
DOI: 10.1177/0883073817701047
PMID: 28395573

Risk Factors for Hip Displacement in Children With Cerebral Palsy: Systematic Review.
Pruszczynski B, Sees J, Miller F.
J Pediatr Orthop. 2016 Dec;36(8):829-833.

BACKGROUND: When hip displacement in children with cerebral palsy (CP) is identified early, treatment is more successful. The standard test is a radiograph of the pelvis measuring the migration index (MI). Our study aims to

review published literature of the natural history of hip dislocation among children with CP and to define related risk factors to develop screening criteria for early recognition.
METHODS: The review included 10 studies with sample sizes greater than 20 children with CP below18 years who had hips with no surgical intervention or dislocation at initial presentation, minimum 2-year follow-up, and recorded MI, pattern, and Gross Motor Function Classification System (GMFCS) level.
RESULTS: On the basis of this review, we suggest screening with 1 radiograph for GMFCS I and II, or, if MI>30%, an annual radiograph between ages 2 and 8 years, followed by a radiograph every 2 years until the age of 18 years. For GMFCS III, IV, and V, we recommend an annual radiograph if MI<30% or 1 every 6 months if MI>30% between ages 2 and 8 years, followed by radiograph every 2 years until the age of 18 years.
CONCLUSIONS: Applying a practical surveillance program for children with CP can prevent hip dislocation, provide early treatment, and ultimately lead to consistently better outcomes than those of neglected hip dislocations. The GMFCS level has a strong impact on subluxation risk and that the risk continues to the end of growth.
LEVEL OF EVIDENCE: Level III-systematic review.
DOI: 10.1097/BPO.0000000000000577
PMID: 26090973 [Indexed for MEDLINE]

Scoliosis in Patients with Severe Cerebral Palsy: Three Different Courses in Adolescents.
Oda Y, Takigawa T, Sugimoto Y, Tanaka M, Akazawa H, Ozaki T.
Acta Med Okayama. 2017 Apr;71(2):119-126. doi: 10.18926/AMO/54980.

Patients with cerebral palsy (CP) frequently present with scoliosis; however, the pattern of curve progression is difficult to predict. We aimed to clarify the natural course of the progression of scoliosis and to identify scoliosis predictors. This was a retrospective, single-center, observational study. Total of 92 CP patients from Asahikawasou Ryouiku Iryou Center in Okayama, Japan were retrospectively analyzed. Cobb angle, presence of hip dislocation and pelvic obliquity, and Gross Motor Function Classification System (GMFCS) were investigated. Severe CP was defined as GMFCS level IV or V. The mean observation period was 10.7 years. Thirtyfour severe CP patients presented with scoliosis and were divided into 3 groups based on their clinical courses: severe, moderate and mild. The mean Cobb angles at the final follow-up were 129°, 53°, and 13° in the severe, moderate, and mild groups, respectively. The average progressions from 18 to 25 years were 2.7°/year, 0.7°/year, and 0.1°/year in the severe, moderate, and mild curve groups, respectively. We observed the natural course of scoliosis and identified 3 courses based on the Cobb angle at 15 and 18 years of age. This method of classification may help clinicians predict the patients' disease progression.
Free Article
DOI: 10.18926/AMO/54980
PMID: 28420893
Conflict of interest statement: No potential conflict of interest relevant to this article was reported.

Prevalence of Joint Gait Patterns Defined by a Delphi Consensus Study Is Related to Gross Motor Function, Topographical Classification, Weakness, and Spasticity, in Children with Cerebral Palsy.
Nieuwenhuys A, Papageorgiou E, Schless SH, De Laet T, Molenaers G, Desloovere K.
Front Hum Neurosci. 2017 Apr 12;11:185. doi: 10.3389/fnhum.2017.00185. eCollection 2017.

During a Delphi consensus study, a new joint gait classification system was developed for children with cerebral palsy (CP). This system, whose reliability and content validity have previously been established, identified 49 distinct joint patterns. The present study aims to provide a first insight toward the construct validity and clinical relevance of this classification system. The retrospective sample of convenience consisted of 286 patients with spastic CP (3-18 years old, GMFCS levels I-III, 166 with bilateral CP). Kinematic and kinetic trials from three-dimensional gait analysis were classified according to the definitions of the Delphi study, and one classified trial was randomly selected for each included limb (n = 446). Muscle weakness and spasticity were assessed for different muscle groups acting around the hip, knee, and ankle. Subsequently, Pearson Chi square tests, Cramer's V, and adjusted standardized residuals were calculated to explore the strength and direction of the associations between the joint patterns, and the different patient-specific characteristics (i.e., age, GMFCS level, and topographical classification) or clinical symptoms (muscle weakness and spasticity). Patient-specific characteristics showed several significant associations with the patterns of different joints, but the strength of most identified associations was weak. Apart from the knee during stance phase and the pelvis in the sagittal plane, the results systematically showed that the patterns with "minor gait deviations"

were the most frequently observed. These minor deviations were found significantly more often in limbs with a lower level of spasticity and good muscle strength. Several other pathological joint patterns were moderately associated with weakness or spasticity, including but not limited to "outtoeing" for weakness and "intoeing" for spasticity. For the joints in the sagittal plane, significantly stronger associations were found with muscle weakness and spasticity, possibly because most of the evaluated muscles in this study mainly perform sagittal plane motions. Remarkably, the hip patterns in the coronal plane did not associate significantly with any of the investigated variables. Although further validation is warranted, this study contributes to the construct validity of the joint patterns of the Delphi consensus study, by demonstrating their ability to distinguish between clinically relevant subgroups in CP.

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PMCID: PMC5388743
PMID: 28446871

Segmental kinematic analysis of planovalgus feet during walking in children with cerebral palsy.

Kruger KM, Konop KA, Krzak JJ, Graf A, Altiok H, Smith PA, Harris GF.

Gait Posture. 2017 Mar 23;54:277-283. doi: 10.1016/j.gaitpost.2017.03.020. [Epub ahead of print]

Pes planovalgus (flatfoot) is a common deformity among children with cerebral palsy. The Milwaukee Foot Model (MFM), a multi-segmental kinematic foot model, which uses radiography to align the underlying bony anatomy with reflective surface markers, was used to evaluate 20 pediatric participants (30feet) with planovalgus secondary to cerebral palsy prior to surgery. Three-dimensional kinematics of the tibia, hindfoot, forefoot, and hallux segments are reported and compared to an age-matched control set of typically-developing children. Most results were consistent with known characteristics of the deformity and showed decreased plantar flexion of the forefoot relative to hindfoot, increased forefoot abduction, and decreased ranges of motion during push-off in the planovalgus group. Interestingly, while forefoot characteristics were uniformly distributed in a common direction in the transverse plane, there was marked variability of forefoot and hindfoot coronal plane and hindfoot transverse plane positioning. The key finding of these data was the radiographic indexing of the MFM was able to show flat feet in cerebral palsy do not always demonstrate more hindfoot eversion than the typically-developing hindfoot. The coronal plane kinematics of the hindfoot show cases planovalgu s feet with the hindfoot in inversion, eversion, and neutral. Along with other metrics, the MFM can be a valuable tool for monitoring kinematic deformity, facilitating clinical decision making, and providing a quantitative analysis of surgical effects on the planovalgus foot.

DOI: 10.1016/j.gaitpost.2017.03.020
PMID: 28384608

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

Ramstad K, Jahnsen RB, Terjesen T.

Acta Orthop. 2017 Apr;88(2):205-210. doi: 10.1080/17453674.2016.1262685. Epub 2016 Nov 28.

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.

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DOI: 10.1080/17453674.2016.1262685
PMCID: PMC5385117
PMID: 27892753 [Indexed for MEDLINE]

The Differential Effect of Arm Movements during Gait on the Forward Acceleration of the Centre of Mass in Children with Cerebral Palsy and Typically Developing Children.

Meyns P, Molenaers G, Duysens J, Jonkers I.

Front Hum Neurosci. 2017 Mar 1;11:96. doi: 10.3389/fnhum.2017.00096. eCollection 2017.

Background: We aimed to study the contribution of upper limb movements to propulsion during walking in typically developing (TD) children (n = 5) and children with hemiplegic and diplegic cerebral palsy (CP; n = 5 and n = 4, respectively). Methods: Using integrated three-dimensional motion capture data and a scaled generic musculoskeletal model that included upper limbs, we generated torque driven simulations of gait in OpenSim. Induced acceleration analyses were then used to determine the contributions of the individual actuators located at the relevant degrees of freedoms of the upper and lower limb joints to the forward acceleration of the COM at each time point of the gait simulation. The mean values of the contribution of the actuators of upper limbs, lower limbs, and gravity in different phases of the gait cycle were compared between the three groups. Findings: The results indicated a limited contribution of the upper limb actuators to COM forward acceleration compared to the contribution of lower limbs and gravity, in the three groups. In diplegic CP, the contribution of the upper limbs seemed larger compared to TD during the preswing and swing phases of gait. In hemiplegic CP, the unaffected arm seemed to contribute more to COM deceleration during (pre)swing, while the affected side contributed to COM acceleration. Interpretation: These findings suggest that in the presence of lower limb dysfunction, the contribution of the upper limbs to forward propulsion is altered, although they remain negligible compared to the lower limbs and gravity.

Free PMC Article
DOI: 10.3389/fnhum.2017.00096
PMCID: PMC5331063
PMID: 28298890

The mechanics of activated semitendinosus are not representative of the pathological knee joint condition of children with cerebral palsy.

Ateş F, Temelli Y, Yucesoy CA.

J Electromyogr Kinesiol. 2016 Jun;28:130-6. doi: 10.1016/j.jelekin.2016.04.002. Epub 2016 Apr 20.

Characteristic cerebral palsy effects in the knee include a restricted joint range of motion and forcefully kept joint in a flexed position. To show whether the mechanics of activated spastic semitendinosus muscle are contributing to these effects, we tested the hypothesis that the muscle's joint range of force exertion is narrow and force production capacity in flexed positions is high. The isometric semitendinosus forces of children with cerebral palsy (n=7, mean (SD)=7years (8months), GMFCS levels III-IV, 12 limbs tested) were measured intra-operatively as a function of knee angle, from flexion (120°) to full extension (0°). Peak force measured in the most flexed position was considered as the benchmark. However, peak force (mean (SD)=112.4N (54.3N)) was measured either at intermediate or even full knee extension (three limbs) indicating no narrow joint range of force exertion. Lack of high force production capacity in flexed knee positions (e.g., at 120° negligible or below 22% of the peak force) was shown except for one limb. Therefore, our hypothesis was rejected for a vast majority of the limbs. These findings and those reported for spastic gracilis agree, indicating that the patients' pathological joint condition must rely on a more complex mechanism than the mechanics of individual spastic muscles.

DOI: 10.1016/j.jelekin.2016.04.002
PMID: 27128957 [Indexed for MEDLINE]

Toolbox of multiple-item measures aligning with the ICF Core Sets for children and youth with cerebral palsy.

Schiariti V, Tatla S, Sauve K, O'Donnell M.

Eur J Paediatr Neurol. 2017 Mar;21(2):252-263. doi: 10.1016/j.ejpn.2016.10.007.Epub 2016 Nov 4.

Selecting appropriate measure(s) for clinical and/or research applications for children and youth with Cerebral Palsy (CP) poses many challenges. The newly developed International Classification of Functioning, Disability and Health (ICF) Core Sets for children and youth with CP serve as universal guidelines for assessment, intervention and follow-up. The aims of this study were: 1) to identify valid and reliable measures used in studies with children and youth with CP, 2) to characterize the content of each measure using the ICF Core Sets for children and youth with CP as a framework, and finally 3) to create a toolbox of psychometrically sound measures covering the content of each ICF Core Set for children and youth with CP. All clearly defined multiple-item measures used in studies with CP between 1998 and 2015 were identified. Psychometric properties were extracted when available. Construct of the measures were linked to the ICF Core Sets. Overall, 83 multiple-item measures were identified. Of these, 68 measures (80%) included reliability and validity testing. The majority of the measures were discriminative, generic and designed for school-aged children. The degree to which measures with proven psychometric properties represented the ICF Core Sets for children and youth with CP varied considerably. Finally, 25 valid and reliable measures aligned highly with the content of the ICF Core Sets, and as such, these measures are proposed as a novel ICF Core Sets-based toolbox of measures for CP. Our results will guide professionals seeking appropriate measures to meet their research and clinical needs worldwide.

DOI: 10.1016/j.ejpn.2016.10.007
PMID: 27864012 [Indexed for MEDLINE]

The functional muscle-bone unit in children with cerebral palsy.
Duran I, Schütz F, Hamacher S, Semler O, Stark C, Schulze J, Rittweger J, Schoenau E
Osteoporos Int. 2017 Apr 1. doi: 10.1007/s00198-017-4023-2. [Epub ahead of print]

Our results suggest that the prevalence of bone health deficits in children with CP was overestimated, when using only age- and height-adjusted bone mineral content (BMC) and areal bone mineral density (aBMD). When applying the functional muscle-bone unit diagnostic algorithm (FMBU-A), the prevalence of positive results decreased significantly. We recommend applying the FMBU-A when assessing bone health in children with CP.INTRODUCTION: The prevalence of bone health deficits in children with cerebral palsy (CP) might be overestimated because age-and height-adjusted reference percentiles for bone mineral content (BMC) and areal bone mineral density (aBMD) assessed by dual-energy X-ray absorptiometry (DXA) do not consider reduced muscle activity. The aim of this study was to compare the prevalence of positive DXA-based indicators for bone health deficits in children with CP to the prevalence of positive findings after applying a functional muscle-bone unit diagnostic algorithm (FMBU-A) considering reduced muscle activity.
METHODS: The present study was a monocentric retrospective analysis of 297 whole body DXA scans of children with CP. The prevalence of positive results of age-and height-adjusted BMC and aBMD defined as BMC and aBMD below the P3 percentile and of the FMBU-A was calculated.
RESULTS: In children with CP, the prevalence of positive results of age-adjusted BMC were 33.3% and of aBMD 50.8%. Height-adjusted results for BMC and aBMD were positive in 16.8 and 36.0% of cases. The prevalence of positive results applying the FMBU-A regarding BMC and aBMD were significantly ($p < 0.001$) lower than using age- and height-adjusted BMC and aBMD (8.8 and 14.8%).
CONCLUSIONS: Our results suggest that the prevalence of bone health deficits in children with CP was overestimated, when using age- and height-adjusted BMC and aBMD. When applying the FMBU-A, the prevalence decreased significantly. We recommend applying the FMBU-A when assessing bone health in children with CP.DOI: 10.1007/s00198-017-4023-2
PMID: 28365851

Validity and reliability of a locomotor stage-based functional rating scale in spinal cord injury.
Maurer-Burkhard B, Smoor I, von Reumont A, Deckstein G, Stierle I, Rupp R, Schuld C.
Spinal Cord. 2016 Aug;54(8):619-25. doi: 10.1038/sc.2015.223. Epub 2016 Jan 12.

STUDY DESIGN: This is a prospective observational cohort study.
OBJECTIVES: The objectives of this study were to apply and adapt a rating scale based on locomotor stages (LSs) derived from cerebral palsy (CP) to spinal cord injury (SCI) and to quantify its inter-rater reliability and construct validity.

METHODS: The inter-rater reliability of LSs originally developed for children with CP was tested in a chronic SCI cohort. On the basis of the distribution of the LSs for CP, Locomotor Stages in Spinal Cord Injury (LOSSCI) were defined.Their validity was then tested with the Spinal Cord Independence Measure (SCIM) in another acute SCI cohort.
RESULTS: The 10-point LSs for CP were assessed by two raters in 65 chronic patients. Weighted Cohen's kappa (WCk) was 0.985 (P<0.0001). Only four mismatches were found, resulting in an accuracy of 93.4%. On the basis of the distribution of the LSs for CP in SCI, the five-point LOSSCI grading scale was developed. WCk of LOSSCI was 0.976 (P<0.0001). Only three mismatches between raters were found, resulting in an overall accuracy of 95.1%. The validity data sets consisted of 448 SCIM records from 161 patients obtained within the first year after injury. Spearman's correlation coefficients were the highest between LOSSCI and SCIM indoor mobility (room and toilet; R=0.82) and the lowest between LOSSCI and SCIM respiration and sphincter management (R=0.68).
CONCLUSION: LOSSCI provides a reliable and valid clinical tool to assess locomotor function in SCI. LOSSCI not only reflects bipedal walking but also covers a wide range of key motor skills.
DOI: 10.1038/sc.2015.223
PMID: 26754473 [Indexed for MEDLINE]

Validity and test-retest reliability of Children's Hand-use Experience Questionnaire in children with unilateral cerebral palsy.
Amer A, Eliasson AC, Peny-Dahlstrand M, Hermansson L.
Dev Med Child Neurol. 2016 Jul;58(7):743-9. doi: 10.1111/dmcn.12991. Epub 2015 Nov 26.

AIM: To investigate the validity of the internet-based version of the Children's Hand-use Experience Questionnaire (CHEQ) by testing the new four-category rating scale, internal structure, and test-retest reliability.
METHOD: Data were collected for 242 children with unilateral cerebral palsy (CP) (137 males and 105 females; mean age 9y 10mo, SD 3y 5mo, range 6-18y). Twenty children from the study sample (mean age 11y 8mo, SD 3y 10mo) participated in a retest within 7 to 14 days. Validity was tested by Rasch analysis based on a rating scale model and test-retest reliability by Kappa analysis and intraclass correlation coefficient (ICC).
RESULTS: The four-category rating scale was within recommended criteria for rating scale structure. One item was removed because of misfit. CHEQ showed good scale structure according to the criteria. The effective operational range was >90% for two of the CHEQ scales. Test-retest reliability for the three CHEQ scales was: grasp efficacy, ICC=0.91; time taken, ICC=0.88; and feeling bothered, ICC=0.91.
INTERPRETATION: The internet-based CHEQ with a four-category rating scale is valid and reliable for use in children with unilateral CP. Further studies are needed to investigate the validity of the internet-based version of CHEQ for children with upper limb reduction deficiency or obstetric brachial plexus palsy and the validity of the recommended improvements to the current version.

DOI: 10.1111/dmcn.12991
PMID: 26610725 [Indexed for MEDLINE]

Cognition

Extrinsic feedback and upper limb motor skill learning in typically-developing children and children with cerebral palsy: Review.
Robert MT, Sambasivan K, Levin MF.
Restor Neurol Neurosci. 2017;35(2):171-184. doi: 10.3233/RNN-160688.

BACKGROUND: Improvment of upper limb motor skills occurs through motor learning that can be enhanced by providing extrinsic feedback. Different types and frequencies of feedback are discussed but specific guidelines for use of feedback for motor learning in typically-developing (TD) children and children with Cerebral Palsy (CP) are not available.
OBJECTIVE: Identify the most effective modalities and frequencies of feedback for improving upper limb motor skills in TD children and children with CP.
METHODS: Ovid MEDLINE, Cochrane, PEDro and PubMed-NCBI were searched from 1950 to December 2015 to identify English-language articles addressing the role of extrinsic feedback on upper limb motor learning in TD children and children with CP. Nine studies were selected with a total of 243 TD children and 102 children with CP.

Study quality was evaluated using the Downs and Black scale and levels of evidence were determined with Sackett's quality ratings.
RESULTS: There was a lack of consistency in the modalities and frequencies of feedback delivery used to improve motor learning in TD children and in children with CP. Moreover, the complexity of the task to be learned influenced the degree of motor learning achieved.
CONCLUSION: A better understanding of the influence of feedback on motor learning is needed to optimize motor skill acquisition in children with CP.
DOI: 10.3233/RNN-160688
PMID: 28282845

Parameters and Measures in Assessment of Motor Learning in Neurorehabilitation; A Systematic Review of the Literature.
Shishov N, Melzer I, Bar-Haim S.
Front Hum Neurosci. 2017 Feb 24;11:82. doi: 10.3389/fnhum.2017.00082. eCollection 2017.

Upper limb function, essential for daily life, is often impaired in individuals after stroke and cerebral palsy (CP). For an improved upper limb function, learning should occur, and therefore training with motor learning principles isincluded in many rehabilitation interventions. Despite accurate measurement being an important aspect for examination and optimization of treatment outcomes, there are no standard algorithms for outcome measures selection. Moreover, the ability of the chosen measures to identify learning is not well established. We aimed to review and categorize the parameters and measures utilized for identification of motor learning in stroke and CP populations. PubMed, Pedro, and Web of Science databases were systematically searched between January 2000 and March 2016 for studies assessing a form of motor learning following upper extremity training using motor control measures. Thirty-two studies in persons after stroke and 10 studies in CP of any methodological quality were included. Identified outcome measures were sorted into two categories, "parameters," defined as identifying a form of learning, and "measures," as tools measuring the parameter. Review's results were organized as a narrative synthesis focusing on the outcome measures. The included studies were heterogeneous in their study designs, parameters and measures. Parameters included adaptation (n = 6), anticipatory control (n = 2), after-effects (n = 3), de-adaptation (n = 4), performance (n = 24), acquisition (n = 8), retention (n = 8), and transfer (n = 14). Despite motor learning theory's emphasis on long-lasting changes and generalization, the majority of studies did not assess the retention and transfer parameters. Underlying measures included kinematic analyses in terms of speed, geometry or both (n = 39), dynamic metrics, measures of accuracy, consistency, and coordination. There is no exclusivity of measures to a specific parameter. Many factors affect task performance and the ability to measure it-necessitating the use of several metrics to examine different features of movement and learning. Motor learning measures' applicability to clinical setting can benefit from a treatment-focused approach, currently lacking. The complexity of motor learning results in various metrics, utilized to assess its occurrence, making it difficult to synthesize findings across studies. Further research is desirable for development of an outcome measures selection algorithm, while considering the quality of such measurements.
Free PMC Article
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PMCID: PMC5324661
PMID: 28286474

Relationship of cognitive functions and gross motor abilities in children with spastic diplegic cerebral palsy.
Al-Nemr A, Abdelazeim F.
Appl Neuropsychol Child. 2017 Apr 18:1-9. doi: 10.1080/21622965.2017.1312402. [Epub ahead of print]

Spastic diplegic cerebral palsy can be accompanied by a myriad of symptoms affecting other body systems including cognitive dysfunction. The purpose of this study was to determine whether a relationship exists between cognitive functions in the form of selective attention and figural memory domains with standing and walking motor abilities in children with diplegic cerebral palsy. The research design was a correlational study. Tasks assessing cognitive function and gross motor abilities were carried out with a sample of 50 children. The data demonstrated the presence of correlation between selective attention and figural memory domains of cognitive function with standing, walking running, and jumping subscales of the Gross Motor Function Measure (GMFM) scale at different ages, and this correlation was significant between selective attention domain and gross motor abilities. The outcome

measurements of the current study provide original evidence based on the necessity of including cognitive and physical impairments in the examination and evaluation of children with diplegic cerebral palsy in research and clinical settings.
DOI: 10.1080/21622965.2017.1312402
PMID: 28418729

Traitement - Rééducation motrice et cognitive

Pharmacologie Efficacite Tolérance

Antibody responses to botulinum neurotoxin type A of toxin-treated spastic equinus children with cerebral palsy: A randomized clinical trial comparing two injection schedules.
Oshima M, Deitiker P, Hastings-Ison T, Aoki KR, Graham HK, Atassi MZ.
J Neuroimmunol. 2017 May 15;306:31-39. doi: 10.1016/j.jneuroim.2017.02.014. Epub 2017 Feb 21.

We have conducted a 26-month-long comparative study involving young patients (2-6years old) with a clinical diagnosis of spastic equinus secondary to cerebral palsy who have been treated with BoNT/A (BOTOX®, Allergan) tri-annually or annually. Serum samples were obtained to determine the presence or absence of blocking antibodies (Abs) by a mouse protection assay (MPA) and levels of anti-BoNT/A Abs by radioimmune assay (RIA). HLA DQ alleles were typed using blood samples to determine the possible association of certain HLA type(s) with the disease or with the Ab status. Blocking Abs were detected in only two out of 18 serum samples of the tri-annual group, but none were found in 20 samples of the annual group. The MPA-positive serum samples gave in RIA significantly higher anti-BoNT/A Ab-binding levels than the MPA-negative samples. On the other hand, when two MPA-positive sample data were excluded, serum samples from tri-annual and annual groups showed similar anti-BoNT/A Ab levels. Linkage of the disorder with a particular HLA DQA1 and DQB1 allele types was not observed due to the small sample size. However, by combining results with other studies on BoNT/A-treated Caucasian patients with cervical dystonia (CD), we found that, among Caucasian patients treated with BoNT/A, DQA1*01:02 and DQB1*06:04 were higher in Ab-positive than in Ab-negative patients. The genetic linkage was on the threshold of corrected significance.

DOI: 10.1016/j.jneuroim.2017.02.014
PMID: 28385185

Injection frequency of botulinum toxin A for spastic equinus: a randomized clinical trial.
Hastings-Ison T, Blackburn C, Rawicki B, Fahey M, Simpson P, Baker R, Graham K.
Dev Med Child Neurol. 2016 Jul;58(7):750-7. doi: 10.1111/dmcn.12962. Epub 2015 Nov 20.

AIM: We compared two botulinum toxin A (BoNT-A) injection frequency regimens, 12-monthly versus 4-monthly, for spastic equinus in a randomized clinical trial. The primary outcome measure was passive ankle dorsiflexion.
METHOD: Forty-two ambulant children with spastic equinus, secondary to cerebral palsy (23 males and 19 females; mean age 3y 6mo, SD 13mo; GMFCS levels I [n=20], II [n=19], III [n=3]) were randomized to receive either 12-monthly or 4-monthly BoNT-A injections to the calf, over a 26-month period. Twenty-one children had spastic hemiplegia, 21 children had spastic diplegia. A fixed 6U/kg dose of Botox was injected into the gastrocnemius muscle of both limbs in children with diplegia and the gastrocsoleus of the affected limb in children with hemiplegia, under mask anaesthesia.
RESULTS: Forty-two children entered the trial with 21 participants randomized to each group. There were three withdrawals and two children received serial casting midway through the trial. There was no significant difference in passive dorsiflexion between 12-monthly and 4-monthly regimens (p=0.41). There were also no significant between group differences on secondary outcome measures. There were no serious adverse events - the rate was 1.2 adverse events per child per year in the 12-monthly group and 2.2 adverse events per child per year in the 4-monthly group. Subgroup analysis revealed a significant difference in passive dorsiflexion between children with hemiplegia and diplegia (p=0.01).
INTERPRETATION: There was no significant difference between 12-monthly and 4-monthly injection regimens on passive dorsiflexion or secondary outcome measures. BoNT-A injections for spastic equinus may be recommended on a 12-monthly basis.

DOI: 10.1111/dmcn.12962
PMID: 26589633 [Indexed for MEDLINE]

Serial Casting as an Adjunct to Botulinum Toxin Type A Treatment in Children With Cerebral Palsy and Spastic Paraparesis With Scissoring of the Lower Extremities.
J Child Neurol. 2017 Jun;32(7):671-675. doi: 10.1177/0883073817701526. Epub 2017 Apr 9.
Dai AI, Demiryürek AT.

The purpose of this study was to examine whether combination therapy of serial casting and botulinum toxin type A injection can further enhance the effects of botulinum toxin type A in children with cerebral palsy with scissoring of both legs. This study was a prospective and randomized trial. The children were divided into 2 groups, one of which received serial casting after botulinum toxin type A (n = 40), and the other which only received botulinum toxin type A (n = 40). Serial casting started 3 weeks after the botulinum toxin type A. Both groups received physiotherapy. Groups were assessed at baseline then compared at 6 and 12 weeks following the intervention. Significant improvements in Gross Motor Function Measure-66 and Caregiver Health Questionnaire were recorded in both groups (P < .001). The modified Ashworth scale improved significantly following botulinum toxin type A in the serial casting group (P < .05), but not in botulinum toxin type A only group. These results suggest that serial casting after botulinum toxin type A can enhance the benefits of botulinum toxin type A
in children with cerebral palsy.
DOI: 10.1177/0883073817701526
PMID: 28393669

The effect of continuous intrathecal baclofen therapy on ambulatory children with cerebral palsy.
Pruszczynski B, Sees J, Hulbert R, Church C, Henley J, Niiler T, Miller F.
J Pediatr Orthop B. 2017 Apr 4. doi: 10.1097/BPB.0000000000000462. [Epub ahead of print]

The effect of a continuous intrathecal infusion of baclofen (CITB) was retrospectively studied in 19 ambulatory children with cerebral palsy (aged 12.4±4.9 years at CITB initiation). The mean clinical follow-up was 5.1±2.4 years and the mean follow-up gait analysis was 2.8±1.9 years. Spastic cerebral palsy diagnosis [14 (74%)] was most frequent. Most patients [11 (58%)] were Gross Motor Function Classification System level III. CITB significantly improved muscle tone and knee flexion at initial contact (P<0.05), but it did not lead to improved gait speed or gross motor function.
DOI: 10.1097/BPB.0000000000000462
PMID: 28379909

Chirurgie

A Modification to the McHale Procedure Reduces Operative Time and Blood Loss.
Godfrey J, McGraw J, Kallur A, Silva S, Szalay E.
J Pediatr Orthop. 2016 Dec;36(8):e89-e95.

BACKGROUND: Treatment of symptomatic spastic hip dislocations in adolescent patients with cerebral palsy includes a variety of described salvage type procedures. In 1990, McHale and colleagues described a technique involving a femoral head resection, valgus-producing proximal femoral osteotomy, and advancement of the lesser trochanter into the acetabulum. We have modified this technique in 3 ways by: performing it in the lateral position with a more posterior approach, not advancing the lesser trochanter into the acetabulum, and closing the capsule over the acetabulum. The purpose of this paper is to describe our technique and to compare the results to Castle type procedures and McHale procedures performed as originally described.
METHODS: We retrospectively reviewed all salvage type procedures performed at our institution for spastic hip dislocations in children with cerebral palsy from 2003 to 2013. Preoperative and postoperative pain, estimated blood loss, operative time, length of stay in the hospital, and postoperative pelvis radiographs were reviewed for heterotopic ossification formation and proximal femoral migration.
RESULTS: Twenty-six patients with 30 hip procedures were reviewed. The modified McHale technique had shorter operative times when compared with the supine McHale technique and the Castle procedure (134, 171, and 139 min, respectively). There was a trend toward less blood loss in the modified McHale technique, but this was not

significant. There was no difference in length of stay in the hospital. The majority of McHale patients (>63%) had pain relief postoperatively, where half of the Castle patients required a revision surgery for pain (4 of 8). There was less heterotopic ossification seen in the modified McHale technique (6.25%) when compared with supine McHale and Castle techniques (both 50%). However, there was more proximal femoral migration in the modified McHale group.
CONCLUSIONS: The modified McHale technique is faster with otherwise equivocal results in the immediate operative periods. There is less heterotopic bone formation but more proximal femoral migration with this new technique.
LEVEL OF EVIDENCE: Level IV-case series.
DOI: 10.1097/BPO.0000000000000634
PMID: 26368855 [Indexed for MEDLINE]

Abnormality of standing posture improves in patients with bilateral spastic cerebral palsy following lower limb surgery.

Buddhdev P, Fry NR, LePage R, Wiley M, Gough M, Shortland AP.
Gait Posture. 2017 Mar 9;54:255-258. doi: 10.1016/j.gaitpost.2017.03.014. [Epub ahead of print]

OBJECTIVES: The degree of abnormality of the gait pattern of children with bilateral spastic cerebral palsy (BSCP) can be reduced by lower limb orthopaedic surgery. However, little attention is paid to the effects of surgery on standing posture. Here, we investigated the abnormality of standing posture in young people with BSCP as well as the effects of surgery on standing posture.
METHODS: We have developed an index of standing posture, the Standing Posture Score (SPS), which is similar in composition to the gait profile score (GPS). We applied SPS retrospectively to 32 typically developing children and 85 children with BSCP before and after surgery to the lower limbs aimed at improving gait. We investigated the relationship between SPS and GPS before surgery and also the relationship between changes in these variables before and after surgery. RESULTS: SPS is significantly higher in young people with BSCP. SPS reduces after surgery and this reduction is correlated with the reduction in GPS.
INTERPRETATION: Successful surgery improves the alignment of the lower limbs in BSCP in standing and may have a positive impact on the activities of daily living which depend on a stable and efficient standing posture.

DOI: 10.1016/j.gaitpost.2017.03.014
PMID: 28371738

Beneficial Effects of Childhood Selective Dorsal Rhizotomy in Adulthood.

Park TS, Edwards C, Liu JL, Walter DM, Dobbs MB.
Cureus. 2017 Mar 5;9(3):e1077. doi: 10.7759/cureus.1077.

BACKGROUND: Selective dorsal rhizotomy (SDR) has been used to treat children with spastic cerebral palsy (CP) for over three decades. However, little is known about the outcomes of childhood SDR in adults. Objectives: 1) To study the effects of childhood SDR on the quality of life and ambulatory function in adult life. 2) To determine late side effects of SDR in adults.
Methods: Adults (> 17.9 years) who underwent SDR in childhood (2 - 17.9 years) between 1987 and 2013 were surveyed in 2015. Patients completed a survey, including questions on demographic information, quality of life, health, surgical outcomes, motor function, manual ability, pain, braces/orthotics, post-SDR treatment, living situation, education level, work status, and side effects of SDR.
Results: In our study population of 294 patients (18.0 - 37.4 years), patients received SDR during the ages of 2.0 - 17.9 years and were followed up 2.2 to 28.3 years after surgery. Eighty-four percent had spastic diplegia, 12% had spastic quadriplegia, and 4% had spastic triplegia. The majority (88%) of patients reported improved post-SDR quality of life and 1% considered the surgery detrimental. Most (83%) would recommend the procedure to others and 3% would not. However, patients who would not recommend SDR to others ambulated with a walker or were not ambulatory at all prior to SDR. The majority (83%) of patients improved (30%) or remained stable (53%) in ambulation. Twenty-nine percent of patients reported pain, mostly in the back and lower limbs, with a mean pain

level of 4.4 ± 2.4 on the Numeric Pain Rating Scale (NPRS). Decreased sensation in small areas of the lower limbs was reported by 8% of patients, though this did not affect daily life. Scoliosis was diagnosed in 28%, with 40% of these patients pursuing treatment. Whether scoliosis was related to SDR is not clear, though scoliosis is known to occur in patients with CP and also in the general population. Only 4% of patients underwent spinal fusion. Orthopedic surgeries were pursued by 59% of patients. The most common orthopedic surgeries were hamstring lengthenings (31%), Achilles tendon lengthenings (18%), adductor lengthenings (16%), and derotational osteotomies (16%). Twenty-four percent of all patients later underwent hip surgery and 8% had surgeries on their knees. Conclusion: Results of this study indicate that the beneficial effects of childhood SDR extend to adulthood quality of life and ambulatory function without late side effects of surgery.
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5382010/
DOI: 10.7759/cureus.1077
PMCID: PMC5382010
PMID: 28401027
Conflict of interest statement: The authors have declared that no competing interests exist.

Correlation of technical surgical goals to the GDI and investigation of post-operative GDI change in children with cerebral palsy.
Bickley C, Linton J, Scarborough N, Sullivan E, Mitchell K, Barnes D.
Gait Posture. 2017 Jun;55:121-125. doi: 10.1016/j.gaitpost.2017.04.015. Epub 2017 Apr 13.

AIM: The purpose of this study was to introduce a standardized set of surgical technical achievement goals (TAGs) as part of a comprehensive outcome assessment model for children with spastic cerebral palsy (CP) undergoing orthopaedic surgical intervention to improve gait. Examination of relationships of these surgical goals to the Gait Deviation Index (GDI) and use of two assessments in tandem provided a thorough picture of technical surgical outcomes. This study also investigated changes in GDI in children with spastic CP after surgery.
METHODS: Data from 269 participants with spastic CP, aged 4 to 19 years with Gross Motor Function Classification System (GMFCS) levels I, II, and III who underwent lower extremity orthopaedic surgical intervention to improve gait were retrospectively analyzed. Data were examined as one heterogeneous group and sub-grouped based on pattern of involvement and GMFCS level to determine change in GDI and relationships between GDI and TAGs.
RESULTS: Differences in TAG achievement and GDI change by GMFCS level suggest a pairing of GDI with another technical measure to be beneficial. Analysis of the outcome tools individually revealed a significant difference between the pre-operative GDI and post-operative GDI mean for the entire group, as well as each of the subgroups. A significant difference in TAG achievement by GMFCS level was also noted.
CONCLUSION: This paper provides evidence that lower extremity orthopedic intervention for the ambulatory child with spastic diplegic or hemiplegic CP improves gait and that a pairing of the GDI and TAGs system is beneficial to capture an accurate technical outcome assessment in both higher and lower functioning patients.

DOI: 10.1016/j.gaitpost.2017.04.015
PMID: 28437759

Effect of selective dorsal rhizotomy on daily care and comfort in non-walkingchildren and adolescents with severe spasticity.
Buizer AI, van Schie PE, Bolster EA, van Ouwerkerk WJ, StrijersRL, van de Pol LA, Stadhouder A, Becher JG, Vermeulen RJ.
Eur J Paediatr Neurol. 2017 Mar;21(2):350-357. doi: 10.1016/j.ejpn.2016.09.006.Epub 2016 Oct 22.

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 [Indexed for MEDLINE]

Effectiveness of surgical and non-surgical management of crouch gait in cerebral palsy: A systematic review.
Galey SA, Lerner ZF, Bulea TC, Zimbler S, Damiano DL.
Gait Posture. 2017 Feb 24;54:93-105. doi: 10.1016/j.gaitpost.2017.02.024. [Epub ahead of print]

BACKGROUND: Cerebral palsy (CP) is a prevalent group of neuromotor disorders caused by early injury to brain regions or pathways that control movement. Patients with CP exhibit a range of functional motor disabilities and pathologic gait patterns. Crouch gait, characterized by increased knee flexion throughout stance, is a common gait pattern in CP that increases energy costs of walking and contributes to ambulatory decline. Our aim was to perform the first systematic literature review on the effectiveness of interventions utilized to ameliorate crouch gait in CP.
METHODS: Comprehensive searches of five medical databases yielded 38 papers with 30 focused on orthopaedic management.
RESULTS: Evidence supports the use of initial hamstring lengthenings and rectus femoris transfers, where indicated, for improving objective gait measures with limited data on improving gait speed or gross motor function. In contrast, evidence argues against hamstring transfers and revision hamstring lengthening, with recent interest in more technically demanding corrective procedures. Only eight studies evaluated alternatives to surgery, specifically strength training, botulinum toxin or orthoses, with inconsistent and/or short-lived results.
CONCLUSIONS: Although crouch in CP is recognized clinically as a complex multi-joint, multi-planar gait disorder, this review largely failed to identify interventions beyond those which directly address sagittal plane knee motion, indicating a major knowledge gap. Quality of existing data was notably weak, with few studies properly controlled or adequately sized. Outcomes from specific procedures are confounded by multilevel surgeries. Successful longer term strategies to prevent worsening of crouch and subsequent functional decline are needed.
LEVEL OF EVIDENCE: Systematic review.

DOI: 10.1016/j.gaitpost.2017.02.024
PMID: 28279852

Electromagnetic Tracking for Femoral Derotation Osteotomy - An in vivo study.
Geisbüsch A, Auer C, Dickhaus H, Putz C, Dreher T.
J Orthop Res. 2017 Apr 17. doi: 10.1002/jor.23579. [Epub ahead of print]

Femoral derotation osteotomy delivers good to excellent results in the treatment of rotational gait abnormalities and especially in internal rotation gait. The outcome of the procedure has been evaluated in numerous short and long term studies. Although reasons for recurrence and over-/under-correction have been unveiled in earlier studies the mechanisms are still not fully understood. False intra-operative assessment of the derotation angle may contribute to imprecise outcomes. In a recent saw-bone study we evaluated an electromagnetic tracking system in comparison to conventional goniometer measurement and a CT reference measurement and found it to be extremely accurate, whereas the use of a conventional goniometer for derotation measurement showed a high inter- and intra-rater variability. The current study evaluates the electromagnetic tracking system for continuous intraoperative derotation control under real OR conditions.Adults (age: 18-40 years) with the diagnosis of internal rotation gait, independent of the underling pathology, undergoing a supracondylar deroation osteotomy were included. A rotational CT scan was conducted before and in close proximity after surgery and the difference served as reference for the electromagnetic tracking results. The results showed a mean deviation of 2.6° (1.2°-5.5°) in

comparison to the reference measurement of the pre- and post-operative CT scans. The system proved to be stable under OR conditions with a good usability and a small technical footprint. Electromagnetic tracking delivers a precise, reliable and independent assessment of intraoperative derotation angles in femoral derotation osteotomies.

DOI: 10.1002/jor.23579
PMID: 28419537

Guided Growth of the Proximal Femur for Hip Displacement in Children With Cerebral Palsy.
Lee WC, Kao HK, Yang WE, Ho PC, Chang CH.
J Pediatr Orthop. 2016 Jul-Aug;36:511-5. doi: 10.1097/BPO.0000000000000480.

BACKGROUND: Guided growth by 1 eccentric transphyseal screw has been used to correct lower limb deformities. Pilot animal studies showed encouraging results in producing varus deformity in the proximal femur. The purpose of this study was to report the preliminary results of guided growth surgery to treat spastic hip displacement.
METHODS: This case series study included consecutive patients who received soft-tissue release and guided growth at the proximal femur from January 2004 to May 2012 with minimal 2-year follow-up. Surgical indications were children with spastic cerebral palsy aged 4 to 10 years, a gross motor function classification system level IV or V, and hip displacement on 1 or both sides. Study outcomes were Reimer's migration percentage (MP) and the head-shaft angle (HSA).
RESULTS: Nine children with 13 spastic displaced hips received surgery at the age of 6.2 years and were followed up for a mean of 45.6 months. The mean MP improved significantly from 52.2% preoperatively to 45.8% at 3 months, 40.3% at 1 year, and 37.1% at 2 years after operation. HSA was unchanged in the first 3 months , and deceased from 173.3 to 166.4 degrees at 1 year (P<0.01) and to 162.7 degrees at 2 years postoperatively. The screw was usually backed out from the femoral epiphysis in the second postoperative year, and no radiologic bony bar or other surgical complications occurred.
CONCLUSIONS: The immediate postoperative improvement of MP was the result of soft-tissue release. From postoperative 3 months to 2 years, the HSA was reduced by 10.6 degrees and the MP further improved by 8.7%. Less surgical dissection, faster recovery of motion, and less comorbidity than varus osteotomy make guided growth surgery a treatment option for coxa valga in spastic hip displacement in nonambulant cerebral palsy children.
LEVEL OF EVIDENCE: Level IV-therapeutic, case series.
DOI: 10.1097/BPO.0000000000000480
PMID: 25887815 [Indexed for MEDLINE]

Hip Reconstruction in Children With Unilateral Cerebral Palsy and Hip Dysplasia.
Abousamra O, Er MS, Rogers KJ, Nishnianidze T, Dabney KW, Miller F.
J Pediatr Orthop. 2016 Dec;36(8):834-840.

BACKGROUND: Highly functioning children with unilateral cerebral palsy (CP) who have hip involvement (type IV hemiplegia) may present with hip dysplasia during their adolescence. The aim of this report is to assess the outcomes of combined femoral and acetabular reconstruction in this population.
METHODS: This study is a retrospective review of all patients with unilateral CP, Gross Motor Function Classification System types I and II, who had hip reconstruction for unilateral dysplasia between 1989 and 2013. Clinical variables (pain and hip passive range of motion) were reviewed. Hip morphology was assessed radiographically according to Melbourne Cerebral Palsy Hip Classification System.Three-dimensional gait analyses were also reviewed to evaluate the effect of surgery on these patients' gaits.
RESULTS: Twelve patients were included with a mean age at surgery of 14 years (range, 7 to 19 y) and follow-up mean of 4 years (range, 1 to 8 y). Nine hips were improved according to Melbourne Cerebral Palsy Hip Classification System. Migration percentage decreased significantly (P<0.001) from 45% (30% to 86%) to 15% (0% to 28%). Neck shaft angle decreased (P<0.001) from 144 degrees (range, 129 to 156 degrees) to 125 degrees (range, 114 to 139 degrees). Tonnis angle and Sharp angle also decreased significantly. All patients were pain free at the last visit. Overall level of gait function as measured by Gait Deviation Index and Gait Profile Score [78 (61 to 89) and 12 (8 to 16), respectively] for all patients was maintained without significant changes.
CONCLUSIONS: In hemiplegic type IV CP, with high functional level (Gross Motor Function Classification System I and II), hip dysplasia is a rare occurrence during adolescent years. Combined hip reconstruction improves hip morphology, relieves pain, and maintains a high level of function.

LEVEL OF EVIDENCE: Level IV-therapeutic study.
DOI: 10.1097/BPO.0000000000000563
PMID: 26057069 [Indexed for MEDLINE]

Infra-Conus Single-Level Laminectomy for Selective Dorsal Rhizotomy: Technical Advance.
Bales J, Apkon S, Osorio M, Kinney G, Robison RA, Hooper E, Browd S.
Pediatr Neurosurg. 2016;51(6):284-291. Epub 2016 Aug 23.

BACKGROUND/AIMS: Selective dorsal rhizotomy for spastic cerebral palsy is an effective and well-validated surgical approach. Multiple techniques have been described in the past including multiple laminectomies and a single-level laminectomy at the level of the conus. There is considerable technical challenge involved with a single-level laminectomy approach.
METHODS: We report here a modification of the single-level laminectomy that selectively analyzes each individual nerve root with electromyography to separate dorsal and ventral nerve roots through comparison of stimulus responses.
RESULTS: In 18 children with cerebral palsy who underwent this operation there was a mean improvement in the Modified Ashworth Scale of 2.0 with no reported incidence of muscle weakness, sensory loss, or neurogenic bladder.
CONCLUSION: This approach allows for a modification of selective dorsal rhizotomy through a single-level laminectomy and tailors the selection of nerve root sectioning to the individual patient of interest while still maintaining its effectiveness.

DOI: 10.1159/000448046
PMID: 27548353 [Indexed for MEDLINE]

Is percutaneous medial hamstring myofascial lengthening as anatomically effective and safe as the open procedure?
Mansour T, Derienne J, Daher M, Sarraf D, Zoghbi Y, Ghanem I.
J Child Orthop. 2017;11:15-19. doi: 10.1302/1863-2548-11-160175.

BACKGROUND: Medial hamstring fractional lengthening is commonly performed in children with cerebral palsy (CP) to decrease contracture and/or to improve gait. Percutaneous procedures are gaining more and more popularity, even in the paediatric population, with equivocal results. The purpose of this paper was to determine the efficacy and safety of percutaneous medial hamstring myofascial lengthening (PHL).
METHODS: This is a prospective randomised controlled trial including 31 knees from 18 consecutive patients with CP scheduled for medial hamstring lengthening in the setting of multilevel tendon lengthening procedures in a university hospital. Other concomitant lower extremity surgeries were not exclusionary. A first paediatric orthopaedic surgeon executes the PHL at one level, as recently described in the literature. Another surgeon opens and extends the wound to explore what had been cut during the PHL and completes fractional lengthening (OHL) of both the semimembranosus (SM) and semitendinosus (ST) when possible. Popliteal angle (PA) was assessed by a third surgeon immediately before PHL, after PHL and then after OHL, using a goniometer in a standardised reproducible manner. All three surgeons were blinded to the others' findings. Primary endpoints included ease of performing PHL, the percentage of tendon-fascia/ muscle portion sectioned percutaneously and improvement of PA. Comparison between improvement of PA after PHL and OHL was done using a paired t-test with a 95% confidence interval.
RESULTS: The first surgeon was at ease in palpating and identifying the semimembranosus tendon before PHL in ten knees only. PHL led to an undesirable cut of the semimembranosus muscle fibres to more than 50% of the muscle section area in eight cases (<50% in 23 cases, between 50% and 75% in eight cases), and of the semitendinosus muscle fibres to more than 50% in all cases (complete rupture in six cases, more than 75% in eight cases and approximately 50% in 17 cases). Mean PA measured 52° pre-operatively and decreased to 40° after PHL. After OHL, the PA averaged 22°. There was a significant difference between the PA value after PHL ($M = 40$, $SD = 11.8$) and the PA value after OHL ($M = 22$, $SD = 8.7$), $p < 0.0001$. The gain in PA did not correlate with the extent of semimembranosus muscle divided ($p = 0.38$) nor with the extent of semitendinosus muscle divided ($p = 0.35$). No major iatrogenic neurovascular injury was observed.
CONCLUSIONS: To the authors' knowledge, this is the first prospective study concerning the anatomic effects of PHL. Although it is a quick procedure, it is often associated with difficulty by the operating surgeon to identify and

evaluate what should be cut percutaneously, leading to abusive injury of the muscle itself rather than the fascia alone. In addition, the gain in PA is statistically less following PHL than following OHL despite undesirable extensive muscle injury following PHL. This may be due to the multiple fascial cuts (fractional lengthening) usually performed in OHL.

Free PMC Article

DOI: 10.1302/1863-2548-11-160175
PMCID: PMC5382331
PMID: 28439304

Neurosurgical Management of Childhood Spasticity: Functional Posterior Rhizotomy and Intrathecal Baclofen Infusion Therapy.

Morota N, Ihara S, Ogiwara H.

Neurol Med Chir (Tokyo). 2015;55(8):624-39. doi: 10.2176/nmc.ra.2014-0445. Epub 2015 Jul 31.

A paradigm shift is currently ongoing in the treatment of spasticity in childhood in Japan. Functional posterior rhizotomy (FPR), which was first introduced to Japan in 1996, is best indicated for children with spastic cerebral palsy, regardless of the clinical severity of spasticity. Surgery is generally carried out in the cauda equina, where the posterior root is separated from the anterior one, and neurophysiological procedures are used to judge which nerve root/rootlet should be cut. The outcome of FPR is favorable for reducing spasticity in the long-term follow-up. Intrathecal baclofen (ITB) treatment for childhood spasticity was approved in 2007 in Japan and the number of children undergoing ITB pump implantation has been gradually increasing. ITB treatment is best indicated for children with severe spasticity, especially those with dystonia, regardless of the pathological background. Since it is a surgery performed to implant foreign bodies, special attention should be paid to avoid perioperative complications such as CSF leakage, meningitis, and mechanical failure. Severely disabled children with spasticity would benefit most from ITB treatment. We would especially like to emphasize the importance of a strategic approach to the treatment of childhood spasticity. The first step is to reduce spasticity by FPR, ITB, and botulinum toxin injection. The second step is to aim for functional improvement after controlling spasticity. Traditional orthopedic surgery and neuro-rehabilitation form the second step of treatment. The combination of these treatments that allows them to complement each other is the key to a successful treatment of childhood spasticity.

Free PMC Article

DOI: 10.2176/nmc.ra.2014-0445
PMCID: PMC4628153
PMID: 26227057 [Indexed for MEDLINE]

Pediatric Hand Surgery Training in Nicaragua: A Sustainable Model of Surgical Education in a Resource-Poor Environment.

Manske MCB, Rios Roque JJ, Zelaya GR, James MA.

Front Public Health. 2017 Apr 11;5:75. doi: 10.3389/fpubh.2017.00075. eCollection 2017.

Recent reports have demonstrated that nearly two-thirds of the world's population do not have access to adequate surgical care, a burden that is borne disproportionately by residents of resource-poor countries. Although the reasons for limited access to surgical care are complex and multi-factorial, among the most substantial barriers is the lack of trained surgical providers. This is particularly true in surgical subspecialties that focus on life-improving, rather than life-saving, treatments, such as pediatric hand and upper extremity surgery, which manages such conditions as congenital malformations, trauma and post-traumatic deformities including burns, and neuromuscular conditions (brachial plexus birth palsy, spinal cord injury, and cerebral palsy). Many models of providing surgical care in resource-limited environments have been described and implemented, but few result in sustainable models of health-care delivery. We present our experience developing a pediatric hand and upper extremity surgery training program in Nicaragua, a resource-limited nation, that grew out of a collaboration of American and Nicaraguan orthopedic surgeons. We compare this experience to that of surgeons undergoing subspecialty training in pediatric upper limb surgery in the US, highlighting the similarities and differences of these training programs. Finally, we assess the results of this training program and identify areas for further growth and development.

Free PMC Article

DOI: 10.3389/fpubh.2017.00075
PMCID: PMC5387056
PMID: 28443277

Proximal femoral osteotomy in children with cerebral palsy: the perspective of the trainee.
Zhou L, Camp M, Gahukamble A, Willoughby KL, Harambasic M, Molesworth C, Khot A, Graham HK
J Child Orthop. 2017;11(1):6-14. doi: 10.1302/1863-2548-11-160226.

BACKGROUND: There are a range of implants for fixation of proximal femoral osteotomies (PFOs) in children. We investigated the training experiences and preferences of orthopaedic residents and fellows who were learning PFO, using a fixed angled blade plate (ABP) or a locking, cannulated blade plate (LCBP). We also studied short-term technical and radiographic outcomes.
METHODS: This was a prospective, parallel-group, cohort study of 90 consecutive children and adolescents with cerebral palsy who underwent bilateral PFOs with ABP or LCBP. Surgical trainees completed a questionnaire to document the ease or difficulty of each operative step.
RESULTS: There were 48 boys and 42 girls, with a mean age of eight years and a mean follow-up of 25 months. Trainees preferred the LCBP system for: insertion of the guidewire, the seating chisel and the blade plate, as well as overall technical ease of use ($p < 0.001$). Radiographic outcomes were similar with no between-group differences for migration percentage ($p = 0.996$) or neck shaft angle ($p = 0.849$), but there was a higher prevalence of technical errors in the ABP group.
CONCLUSIONS: Trainee surgeons expressed a preference for LCBPs when learning PFO in children with cerebral palsy. Radiographic outcomes were similar in both groups, with close attending surgeon supervision.

Free PMC Article
DOI: 10.1302/1863-2548-11-160226
PMCID: PMC5382338
PMID: 28439303

Rectus Femoris Transfer Surgery Worsens Crouch Gait in Children With Cerebral Palsy at GMFCS Levels III and IV.
Sousa TC, Nazareth A, Rethlefsen SA, Mueske NM, Wren TA, Kay RM.
J Pediatr Orthop. 2017 Apr 3. doi: 10.1097/BPO.0000000000000988. [Epub ahead of print]

BACKGROUND: Previous study has shown that children with cerebral palsy (CP) functioning at Gross Motor Function Classification System (GMFCS) levels III and IV do not benefit from distal rectus femoris transfer (DRFT) due to lack of improvement in stance knee extension. The fate of knees in such subjects who do not undergo DRFT is unknown. The purpose of this study was to compare knee kinematic outcomes in patients with CP and stiff knee gait who underwent single-event multilevel surgery with and without DRFT.
METHODS: Preoperative and postoperative gait analysis data were retrospectively reviewed for ambulatory (GMFCS levels I to IV) patients with CP with crouch and stiff knee gait whom underwent single-event multilevel surgery, including hamstring lengthening either with DRFT (N=34) or without DRFT (N=40). Statistical analyses included t tests and χ tests, and multiple regression analysis was performed to adjust for covariates. Data were stratified by GMFCS level groups I/II and III/IV.
RESULTS: Improved maximum knee extension in stance was seen for both the DRFT ($P=0.0002$) and no DRFT groups ($P\leq0.0006$) at GMFCS levels I/II, and the no DRFT group at GMFCS levels III/IV ($P=0.02$). Excessive stance knee flexion persisted for those at GMFCS level III/IV after DRFT. Maximum knee flexion in swing was maintained after DRFT, but significantly decreased in the no DRFT group ($P<0.002$) for both GMFCS groups. Change in total knee range of motion improved after DRFT only in the GMFCS I/II group subjects with unilateral involvement ($P=0.01$). Timing of maximum knee flexion in swing improved for all patients regardless of DRFT or GMFCS level group ($P<0.0001$).
CONCLUSIONS: In patients with CP functioning at GMFCS levels III and IV, DRFT results in persistent crouch postoperatively. Given the importance of maintaining upright posture in these patients, we do not recommend DRFT in patients functioning at GMFCS levels III and IV.
LEVEL OF EVIDENCE: Level III-retrospective comparative study.
DOI: 10.1097/BPO.0000000000000988
PMID: 28375967

Risk factors for surgical site infection following nonshunt pediatric neurosurgery: a review of 9296 procedures from a national database and comparison with a single-center experience.
Sherrod BA, Arynchyna AA, Johnston JM, Rozzelle CJ, Blount JP, Oakes WJ, Rocque BG.
J Neurosurg Pediatr. 2017 Apr;19(4):407-420. doi: 10.3171/2016.11.PEDS16454. Epub 2017 Feb 10.

OBJECTIVE Surgical site infection (SSI) following CSF shunt operations has been well studied, yet risk factors for nonshunt pediatric neurosurgery are less well understood. The purpose of this study was to determine SSI rates and risk factors following nonshunt pediatric neurosurgery using a nationwide patient cohort and an institutional data set specifically for better understanding SSI.
METHODS The authors reviewed the American College of Surgeons National Surgical Quality Improvement Program-Pediatric (ACS NSQIP-P) database for the years 2012-2014, including all neurosurgical procedures performed on pediatric patients except CSF shunts and hematoma evacuations. SSI included deep (intracranial abscesses, meningitis, osteomyelitis, and ventriculitis) and superficial wound infections. The authors performed univariate analyses of SSI association with procedure, demographic, comorbidity, operative, and hospital variables, with subsequent multivariate logistic regression analysis to determine independent risk factors for SSI within 30 days of the index procedure. A similar analysis was performed using a detailed institutional infection database from Children's of Alabama (COA).
RESULTS A total of 9296 nonshunt procedures were identified in NSQIP-P with an overall 30-day SSI rate of 2.7%. The 30-day SSI rate in the COA institutional database was similar (3.3% of 1103 procedures, p = 0.325). Postoperative time to SSI in NSQIP-P and COA was 14.6 ± 6.8 days and 14.8 ± 7.3 days, respectively (mean ± SD). Myelomeningocele (4.3% in NSQIP-P, 6.3% in COA), spine (3.5%, 4.9%), and epilepsy (3.4%, 3.1%) procedure categories had the highest SSI rates by procedure category in both NSQIP-P and COA. Independent SSI risk factors in NSQIP-P included postoperative pneumonia (OR 4.761, 95% CI 1.269-17.857, p = 0.021), immune disease/immunosuppressant use (OR 3.671, 95% CI 1.371-9.827, p = 0.010), cerebral palsy (OR 2.835, 95% CI 1.463-5.494, p = 0.002), emergency operation (OR 1.843, 95% CI 1.011-3.360, p = 0.046), spine procedures (OR 1.673, 95% CI 1.036-2.702, p = 0.035), acquired CNS abnormality (OR 1.620, 95% CI 1.085-2.420, p = 0.018), and female sex (OR 1.475, 95% CI 1.062-2.049, p = 0.021). The only COA factor independently associated with SSI in the COA database included clean-contaminated wound classification (OR 3.887, 95% CI 1.354-11.153, p = 0.012), with public insurance (OR 1.966, 95% CI 0.957-4.041, p = 0.066) and spine procedures (OR 1.982, 95% CI 0.955-4.114, p = 0.066) approaching significance. Both NSQIP-P and COA multivariate model C-statistics were > 0.7.
CONCLUSIONS The NSQIP-P SSI rates, but not risk factors, were similar to data from a single center.
DOI: 10.3171/2016.11.PEDS16454
PMID: 28186476 [Indexed for MEDLINE]

Single-stage Anterior and Posterior Fusion Surgery for Correction of Cervical Kyphotic Deformity Using Intervertebral Cages and Cervical Lateral Mass Screws: Postoperative Changes in Total Spine Sagittal Alignment in Three Cases with a Minimum Follow-up of Five Years.

Ogihara S, Kunogi J.

Neurol Med Chir (Tokyo). 2015;55(7):599-604. doi: 10.2176/nmc.cr.2014-0263. Epub 2015 Jun 29.

The surgical treatment of cervical kyphotic deformity remains challenging. As a surgical method that is safer and avoids major complications, the authors present a procedure of single-stage anterior and posterior fusion to correct cervical kyphosis using anterior interbody fusion cages without plating, as illustrated by three consecutive cases. Case 1 was a 78-year-old woman who presented with a dropped head caused by degeneration of her cervical spine. Case 2 was a 54-year-old woman with athetoid cerebral palsy. She presented with cervical myelopathy and cervical kyphosis. Case 3 was a 71-year-old woman with cervical kyphotic deformity following a laminectomy. All three patients underwent anterior release and interbody fusion with cages and posterior fusion with cervical lateral mass screw (LMS) fixation. Postoperative radiographs showed that correction of kyphosis was 39° in case 1, 43° in case 2, and 39° in case 3. In all three cases, improvement of symptoms was established without major perioperative complications, solid fusion was achieved, and no loss of correction was observed at a minimum follow-up of 61 months. We also report that preoperative total spine sagittal malalignment was improved after corrective surgery for cervical kyphosis and was maintained at the latest follow-up in all three cases. The combination of anterior fusion cages and LMS is considered a safe and effective procedure in cases of severe cervical kyphotic deformity. Preoperative total spine sagittal malalignment improved, accompanied by correction of cervical kyphosis, and was maintained at last follow-up in all three cases.
Free PMC Article
DOI: 10.2176/nmc.cr.2014-0263
PMCID: PMC4628194
PMID: 26119893 [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. 2017 Apr;88(2):198-204. doi: 10.1080/17453674.2016.1263110. Epub 2016 Nov 28.

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.
Free PMC Article
DOI: 10.1080/17453674.2016.1263110
PMCID: PMC5385116
PMID: 27892801 [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 [Indexed for MEDLINE]

The Direct Anterior Approach for Complex Primary Total Hip Arthroplasty: The Extensile Acetabular Approach on a Regular Operating Room Table.

Molenaers B, Driesen R, Molenaers G, Corten K.

J Arthroplasty. 2017 May;32(5):1553-1559. doi: 10.1016/j.arth.2016.12.016. Epub 2016 Dec 22.

BACKGROUND: The direct anterior approach on a regular operating room table has been reported with low dislocation rates. This might be beneficial for complex primary total hip arthroplasty (THA) such as in patients with cerebral palsy or following femoral or pelvic osteotomies. Extending the approach is often required to overcome problems such as acetabular deformities or severe contractures.
METHODS: We retrospectively evaluated the results and complications of 29 patients with 37 complex primary THA in which an extensile approach was used. The extensile approach is described. Functional scores were collected in case the patient was ambulatory independently (n = 17).
RESULTS: The average age was 35 years (range 15-85) with a mean follow-up of 39 months (range 12-60). There were 3 (8%) intra-operative and 4 (11%) early post-operative complications (<3 months), of which 3 (8%) were anterior dislocations. Late complications (>3 months) consisted of a fibrous ingrown stem, a socket loosening following a pelvic fracture, and a late hematogenous infection (8%). Seventy-one percent of the complications occurred in the first 18 cases (49%) indicating a learning curve. The mean post-operative Harris Hip Score was 79 (range 56-97).
CONCLUSION: Complex THA can be safely conducted through the extensile anterior approach on a regular operating room table with the use of conventional implants, even in cases with a high risk of dislocation.

DOI: 10.1016/j.arth.2016.12.016
PMID: 28087159 [Indexed for MEDLINE]

The Effect of Body Mass Index on Postoperative Morbidity After Orthopaedic Surgery in Children With Cerebral Palsy.

Minhas SV, Chow I, Otsuka NY.

J Pediatr Orthop. 2016 Jul-Aug;36(5):505-10. doi: 10.1097/BPO.0000000000000475.

BACKGROUND: Although a plethora of literature exists on the impact of body mass index (BMI) in orthopaedic surgery, few have examined its implications in the pediatric cerebral palsy (CP) population. The aim of this study is to evaluate the effect of BMI class on 30-day complications after orthopaedic surgery on children with CP.
METHODS: A retrospective analysis of the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) Pediatric participant use files from 2012 to 2013 was conducted. Patients with a diagnosis of CP undergoing any orthopaedic procedure were included and subclassified according to BMI classes: underweight, normal weight, overweight, and obese. Multivariate logistic regressions were performed to evaluate the independent effect of BMI class on total, surgical site, and medical complications as well as unplanned reoperations.
RESULTS: A total of 1746 patients were included in our study. These included 345 (19.8%) underweight, 952 (54.5%) normal weight, 209 (12.8%) overweight, and 240 (13.7%) obese children and adolescents. In hip and lower extremity osteotomies, underweight class was an independent risk factor for total complications (P=0.037) and medical complications (P=0.031). Similarly, underweight class was a risk factor for total complications (P=0.022) and medical complications (P=0.019) in spine procedures. Weight class was not independently associated with complications in tendon procedures. Overweight and obesity classes were not associated with any independent increased risk for complications.
CONCLUSIONS: With respect to the pediatric CP population, underweight status was deemed an independent predictor of increased complications in osteotomies and spine surgery with no independent increased risk in the overweight or obese cohorts. This information can greatly aid providers with risk stratification, preoperative counseling, and postoperative monitoring as it relates to
orthopaedic surgery.
LEVEL OF EVIDENCE: Level III-Prognostic.
DOI: 10.1097/BPO.0000000000000475
PMID: 25929775 [Indexed for MEDLINE]

Total Hip Arthroplasty in Patients with Cerebral Palsy: A Cohort Study Matched to Patients with Osteoarthritis.

Houdek MT, Watts CD, Wyles CC, Trousdale RT, Milbrandt TA, Taunton MJ.
J Bone Joint Surg Am. 2017 Mar 15;99(6):488-493. doi: 10.2106/JBJS.16.00528.

BACKGROUND: The spasticity and increased muscle tone observed in patients with cerebral palsy can lead to hip degeneration, subluxation, and pain. Currently, there is hesitation to perform total hip arthroplasty in patients with cerebral palsy because of fears of early wear and dislocation. The purpose of this study was to review the outcomes of total hip arthroplasty in patients with cerebral palsy and to compare outcomes with those of matched patients with a diagnosis of osteoarthritis.
METHODS: Over a 24-year period, 39 patients undergoing a total hip arthroplasty with a diagnosis of cerebral palsy were identified. The cohort included 26 male patients (67%), and the mean patient age was 49 years. The mean follow-up was 7 years. Patients with cerebral palsy were matched 1:2 with a group of patients undergoing total hip arthroplasty for osteoarthritis.
RESULTS: There was no difference in the rate of reoperation, implant survival, or complications, specifically dislocation. Prior to the surgical procedure, all patients had severe or moderate pain, and postoperatively no patient had moderate or severe pain. Twenty-three patients had an improvement in their ability to independently walk, and all preoperative hip flexion contractures were corrected (n = 9). There was also a significant improvement ($p < 0.0001$) in functional Harris hip scores.
CONCLUSIONS: This study refutes previous evidence showing increased risk of complications following total hip arthroplasty in patients with cerebral palsy. Total hip arthroplasty is a durable treatment option and provides clinically important pain relief and functional improvement in patients with cerebral palsy.
LEVEL OF EVIDENCE: Therapeutic Level III. See Instructions for Authors for a complete description of levels of evidence.
DOI: 10.2106/JBJS.16.00528
PMID: 28291181 [Indexed for MEDLINE]

Total Knee Arthroplasty in Patients With Cerebral Palsy: A Matched Cohort Study to Patients With Osteoarthritis.
Houdek MT, Watts CD, Wyles CC, Trousdale RT, Milbrandt TJ, Taunton MJ.
J Am Acad Orthop Surg. 2017 May;25(5):381-388. doi: 10.5435/JAAOS-D-16-00437.

INTRODUCTION: Currently, few data examine the use of total knee arthroplasty (TKA) in patients with cerebral palsy (CP). This study reviewed the outcomes of TKA in patients with CP compared with a matched cohort undergoing TKA for primary osteoarthritis.
METHODS: Over a 28-year period, 15 TKAs in patients with a diagnosis of CP were identified. The cohort was 53% men, with a mean age of 58 years. Patients with CP were matched 1:2 based on age, sex, body mass index, and year of surgery with a group of patients undergoing TKA for osteoarthritis.
RESULTS: No difference was reported in implant survival ($P = 0.27$) or revision surgery ($P = 0.79$) between groups. All patients were ambulatory postoperatively, and significant increases were noted in the Knee Society score ($P < 0.0001$) and functional assessment ($P = 0.003$).
DISCUSSION: TKA is a safe, durable procedure in patients with CP to improve pain and function.
DOI: 10.5435/JAAOS-D-16-00437
PMID: 28379915

Réadaptation fonctionnelle

Constraint-induced movement therapy improves upper limb activity and ticipation in hemiplegic cerebral palsy: a systematic review.
Chiu HC, Ada L.
J Physiother. 2016 Jul;62(3):130-7. doi: 10.1016/j.jphys.2016.05.013. Epub 2016 n 17.

QUESTIONS: Does constraint-induced movement therapy improve activity and participation in children with hemiplegic cerebral palsy? Does it improve activity and participation more than the same dose of upper limb therapy without restraint? Is the effect of constraint-induced movement therapy related to the duration of intervention or the age of the children?
DESIGN: Systematic review of randomised trials with meta-analysis.
PARTICIPANTS: Children with hemiplegic cerebral palsy with any level of motor disability.

INTERVENTION: The experimental group received constraint-induced movement therapy (defined as restraint of the less affected upper limb during supervised activity practice of the more affected upper limb). The control group received no intervention, sham intervention, or the same dose of upper limb therapy.
OUTCOME MEASURES: Measures of upper limb activity and participation were used in the analysis.
RESULTS: Constraint-induced movement therapy was more effective than no/sham intervention in terms of upper limb activity (SMD 0.63, 95% CI 0.20 to 1.06) and participation (SMD 1.21, 95% CI 0.41 to 2.02). However, constraint-induced movement therapy was no better than the same dose of upper limb therapy without restraint either in terms of upper limb activity (SMD 0.05, 95% CI -0.21 to 0.32) or participation (SMD -0.02, 95% CI -0.34 to 0.31). The effect of constraint-induced movement therapy was not related to the duration of intervention or the age of the children.
CONCLUSIONS: This review suggests that constraint-induced movement therapy is more effective than no intervention, but no more effective than the same dose of upper limb practice without restraint.
REGISTRATION: PROSPERO CRD42015024665. [Chiu H-C, Ada L (2016) Constraint-induced movement therapy improves upper limb activity and participation in hemiplegic cerebral palsy: a systematic review.Journal of Physiotherapy62: 130-137].

Free Article
DOI: 10.1016/j.jphys.2016.05.013
PMID: 27323932 [Indexed for MEDLINE]

Do mirror movements relate to hand function and timing of the brain lesion in children with unilateral cerebral palsy?
Klingels K, Jaspers E, Staudt M, Guzzetta A, Mailleux L, Ortibus E, Feys H.
Dev Med Child Neurol. 2016 Jul;58(7):735-42. doi: 10.1111/dmcn.12977. Epub 2015 Dec 8.

AIM: This study aimed to systematically map the severity of mirror movements in both hands in a prospective cohort of children with unilateral cerebral palsy, and to explore the relationship with hand function and brain lesion type.
METHOD: Seventy-eight children were included (41 males, 37 females; age 9y 4mo, SD 3y 1mo, range 5-15y). Mirror movements were scored during three repetitive tasks following Woods and Teuber criteria. Strength, tone, Melbourne Assessment, Jebsen-Taylor test, and Assisting Hand Assessment were evaluated. Lesions were classified into malformations (n=5), periventricular (n=43), cortico-subcortical (n=22), and postnatally acquired lesions (n=8).
RESULTS: Significantly more mirror movements were observed in the non-paretic versus the paretic hand ($p \leq 0.003$). Higher mirror movement scores in the non-paretic hand significantly correlated with lower distal strength and lower scores on unimanual and bimanual assessments ($r=0.29$-0.41). In the paretic hand, significant differences were found between lesion types ($p=0.03$).
INTERPRETATION: The occurrence of mirror movements in the non-paretic hand seems related to hand function while mirror movements in the paretic hand seem more related to the lesion timing, whereby children with earlier lesions present with more mirror movements.

DOI: 10.1111/dmcn.12977
PMID: 26645574 [Indexed for MEDLINE]

Effects of Antigravity Treadmill Training on Gait, Balance, and Fall Risk inChildren With Diplegic Cerebral Palsy.
El-Shamy SM.
Am J Phys Med Rehabil. 2017 Apr 13. doi: 10.1097/PHM.0000000000000752. [Epubahead of print]

OBJECTIVE: The aim of this study was to investigate the effects of antigravity treadmill training on gait, balance, and fall risk in children with diplegic cerebral palsy.
DESIGN: Thirty children with diplegic cerebral palsy were selected for this randomized controlled study. They were randomly assigned to (1) an experimental group that received antigravity treadmill training (20 mins/d, 3 d/wk) together with traditional physical therapy for 3 successive mos and (2) a control group that received only traditional physical therapy program for the same period. Outcomes included selected gait parameters, postural stability, and fall risk. Outcomes were measured at baseline and after 3 mos of intervention.

RESULTS: Children in both groups showed significant improvements in the mean values of all measured variables (P < 0.05), with significantly greater improvements in the experimental group than the control group. The posttreatment gait parameters (i.e., velocity, stride length, cadence, and percent of time spent in double-limb support) were 0.74 m/sec, 119 steps/min, 0.75 m/sec, 0.65 sec, and 55.9% as well as 0.5 m, 125 steps/min, 0.6 m/sec, 0.49 sec, and 50.4% for the experimental and control group, respectively.
CONCLUSIONS: Antigravity treadmill training may be a useful tool for improving gait parameters, balance, and fall risk in children with diplegic cerebral palsy.
DOI: 10.1097/PHM.0000000000000752
PMID: 28410250

Efficacy of Intensive Neurodevelopmental Treatment for Children WithDevelopmental Delay, With or Without Cerebral Palsy.

Lee KH, Park JW, Lee HJ, Nam KY, Park TJ, Kim HJ, Kwon BS.
Ann Rehabil Med. 2017 Feb;41(1):90-96. doi: 10.5535/arm.2017.41.1.90. Epub 2017Feb 28.

OBJECTIVE: To evaluate the effectiveness of intensive neurodevelopmental treatment (NDT) on gross motor function for the children having developmental delay (DD), with or without cerebral palsy (CP).
METHODS: Forty-two children had intensive NDT three times weekly, 60 minutes a day, for 3 months, immediately followed by conventional NDT once or twice a week, 30 minutes a day, for another 3 months. We assessed Gross Motor Function Measure (GMFM) over three time points: before conventional NDT, before and after intensive NDT, and after 3 months of additional conventional NDT.
RESULTS: The GMFM score in DD children significantly improved after intensive NDT, and the improvement maintained after 3 months of conventional NDT ($p<0.05$). The children were further divided into two groups: DD with CP and DD without CP. Both groups showed significant improvement and maintained the improvements, after intensive NDT ($p<0.05$). Also, there was no significant difference in treatment efficacy between the two groups. When we calculate the absence rate for comparing the compliance between intensive and conventional NDT, the absence rate was lower during the intensive NDT.
CONCLUSION: Intensive NDT showed significantly improved gross motor function and higher compliance than conventional NDT. Additionally, all improvements were maintained through subsequent short-term conventional NDT. Thus, we recommend the intensive NDT program by day-hospital centers for children with DD, irrespective of accompanying CP.
Free PMC Article
DOI: 10.5535/arm.2017.41.1.90
PMCID: PMC5344832
PMID: 28289640
Conflict of interest statement: CONFLICT OF INTEREST: No potential conflict of interest relevant to this article was reported.

Evaluation of Functional Mobility Outcomes Following Electrical Stimulation in Children With Spastic Cerebral Palsy.

Mukhopadhyay R, Lenka PK, Biswas A, Mahadevappa M.
J Child Neurol. 2017 Jun;32(7):650-656. doi: 10.1177/0883073817700604. Epub 2017 Apr 9.

This study investigated the clinical feasibility of electrical stimulation in enhancing ankle dorsiflexion of the tibialis anterior muscle to improve mobility in children with spastic cerebral palsy. The intervention group received electrical stimulation therapy for 30 minutes and physiotherapy for another 30 minutes for 5 days a week, up to 12 weeks. Gait parameters, Gross Motor Function Measure, Physiological Cost Index, surface electromyogram, and electroencephalogram (EEG) data were recorded pre- and posttreatment. Data were compared with the control group, which received only conventional physiotherapy for 60 minutes. There was an increase in walking speed (17.67%) and Gross Motor Function Measure scores (2.1%) while the Physiological Cost Index value was decreased (19.7%). The analysis of features extracted from the surface electromyogram showed an increase in muscle strength and that of EEG showed increased motor activities. Hence, electrical stimulation combined with conventional physiotherapy improve gait, muscle strength, and motor activities in children with spastic cerebral palsy.
DOI: 10.1177/0883073817700604
PMID: 28393668

Factors Influencing the Gross Motor Outcome of Intensive Therapy in Children with Cerebral Palsy and Developmental Delay.

Hong BY, Jo L, Kim JS, Lim SH, Bae JM.

J Korean Med Sci. 2017 May;32(5):873-879. doi: 10.3346/jkms.2017.32.5.873.

The study was designed to identify factors influencing the short term effect of intensive therapy on gross motor function in children with cerebral palsy or developmental delay. Retrospectively, total Gross Motor Function Measure-88 (GMFM-88) scores measured during the first and last weeks of intensive therapy were analyzed (n = 103). Good and poor responder groups were defined as those in the top and bottom 25% in terms of score difference, respectively. The GMFM-88 score increased to 4.67 ± 3.93 after 8 weeks of intensive therapy (P < 0.001). Gross Motor Function Classification System (GMFCS) level (I-II vs. IV-V; odds ratio [OR] = 7.763, 95% confidence interval [CI] = 2.177-27.682, P = 0.002) was a significant factor in a good response to therapy. Age (≥ 36 months; OR = 2.737, 95% CI = 1.003-7.471, P = 0.049) and GMFCS level (I-II vs. IV-V; OR = 0.189, 95% CI = 0.057-0.630, P = 0.007; and III vs. IV-V; OR = 0.095, 95% CI = 0.011-0.785, P = 0.029) were significantly associated with a poor response. GMFCS level is the most important prognostic factor for the effect of intensive therapy on gross motor function. In addition, age ≥ 36 months, is associated with a poor outcome.

Free PMC Article

DOI: 10.3346/jkms.2017.32.5.873

PMCID: PMC5383623

PMID: 28378564

Conflict of interest statement: The authors have no potential conflicts of interest to disclose.

Interactive wearable systems for upper body rehabilitation: a systematic review.

Wang Q, Markopoulos P, Yu B, Chen W, Timmermans A.

J Neuroeng Rehabil. 2017 Mar 11;14(1):20. doi: 10.1186/s12984-017-0229-y.

BACKGROUND: The development of interactive rehabilitation technologies which rely on wearable-sensing for upper body rehabilitation is attracting increasing research interest. This paper reviews related research with the aim: 1) To inventory and classify interactive wearable systems for movement and posture monitoring during upper body ehabilitation, regarding the sensing technology, system measurements and feedback conditions; 2) To gauge the wearability of the wearable systems; 3) To inventory the availability of clinical evidence supporting the effectiveness of related technologies.

METHOD: A systematic literature search was conducted in the following search engines: PubMed, ACM, Scopus and IEEE (January 2010-April 2016).

RESULTS: Forty-five papers were included and discussed in a new cuboid taxonomy which consists of 3 dimensions: sensing technology, feedback modalities and system measurements. Wearable sensor systems were developed for persons in: 1) Neuro-rehabilitation: stroke (n = 21), spinal cord injury (n = 1), cerebral palsy (n = 2), Alzheimer (n = 1); 2) Musculoskeletal impairment: ligament rehabilitation (n = 1), arthritis (n = 1), frozen shoulder (n = 1), bones trauma (n = 1); 3) Others: chronic pulmonary obstructive disease (n = 1), chronic pain rehabilitation (n = 1) and other general rehabilitation (n = 14). Accelerometers and inertial measurement units (IMU) are the most frequently used technologies (84% of the papers). They are mostly used in multiple sensor configurations to measure upper limb kinematics and/or trunk posture. Sensors are placed mostly on the trunk, upper arm, the forearm, the wrist, and the finger. Typically sensors are attachable rather than embedded in wearable devices and garments; although studies that embed and integrate sensors are increasing in the last 4 years. 16 studies applied knowledge of result (KR) feedback, 14 studies applied knowledge of performance (KP) feedback and 15 studies applied both in various modalities. 16 studies have conducted their evaluation with patients and reported usability tests, while only three of them conducted clinical trials including one randomized clinical trial.

CONCLUSIONS: This review has shown that wearable systems are used mostly for the monitoring and provision of feedback on posture and upper extremity movements in stroke rehabilitation. The results indicated that accelerometers and IMUs are the most frequently used sensors, in most cases attached to the body through ad hoc contraptions for the purpose of improving range of motion and movement performance during upper body rehabilitation. Systems featuring sensors embedded in wearable appliances or garments are only beginning to emerge. Similarly, clinical evaluations are scarce and are further needed to provide evidence on effectiveness and pave the path towards implementation in clinical settings.

Free PMC Article
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PMCID: PMC5346195
PMID: 28284228

On the Adaptation of Pelvic Motion by Applying 3-dimensional Guidance Forces using TPAD.
Kang J, Vashista V, Agrawal S.
IEEE Trans Neural Syst Rehabil Eng. 2017 Mar 8. doi: 10.1109/TNSRE.2017.2679607. [Epub ahead of print]

Pelvic movement is important to human locomotion as the center of mass is located near the center of pelvis. Lateral pelvic motion plays a crucial role to shift the center of mass on the stance leg while swinging the other leg and keeping the body balanced. In addition, vertical pelvic movement helps to reduce metabolic energy expenditure by exchanging potential and kinetic energy during the gait cycle. However, patient groups with cerebral palsy or stroke have excessive pelvic motion that leads to high energy expenditure. In addition, they have higher chances of falls as the center of mass could deviate outside the base of support. In this study, a novel control method is suggested using Tethered Pelvic Assist Device (TPAD) to teach subjects to walk with a specified target pelvic trajectory while walking on a treadmill. In this method, a force field is applied to the pelvis to guide it to move on a target trajectory and correctional forces are applied if the pelvis motion has excessive deviations from the target trajectory. Three different experiments with healthy subjects were conducted to teach them to walk on a new target pelvic trajectory with the presented control method. For all three experiments, the baseline trajectory of the pelvis was experimentally determined for each participating subject. To design a target pelvic trajectory which is different from the baseline, Experiment I scaled up the lateral component of the baseline pelvic trajectory, while Experiment II scaled down the lateral component of the baseline trajectory. For both Experiments I and II, the controller generated a two dimensional force field in the transverse plane to provide the guidance force. In this study, seven subjects were recruited for each experiment who walked on the treadmill with suggested control methods and visual feedback of their pelvic trajectory. The results show that the subjects were able to learn the target pelvic trajectory in each experiment and also retained the training effects after the completion of the experiment. In Experiment III, both lateral and vertical components of the pelvic trajectory were scaled down from the baseline trajectory. The force field was extended to three dimensions in order to correct the vertical pelvic movement as well. Three subgroups (force feedback alone, visual feedback alone, and both force and visual feedback) were recruited to understand the effects of force feedback and visual feedback alone to distinguish the results from Experiments I and II. The results show that a training method that combines visual and force feedback is superior to the training methods with visual or force feedback alone. We believe that the present control strategy holds potential in training and correcting abnormal pelvic movements in different patient populations.
DOI: 10.1109/TNSRE.2017.2679607
PMID: 28287978

Somatosensory Discrimination Intervention Improves Body Position Sense and Motor Performance in Children With Hemiplegic Cerebral Palsy.
McLean B, Taylor S, Blair E, Valentine J, Carey L, Elliott C.
Am J Occup Ther. 2017 May/Jun;71(3):7103190060p1-7103190060p9. doi: 10.5014/ajot.2016.024968.

OBJECTIVE: This study examined the use of the adult neuroscience-based Sense(©) intervention with children with hemiplegic cerebral palsy (HCP) to improve upper-limb somatosensory discrimination, motor function, and goal performance.
METHOD: Seventeen children with HCP (9 boys, 8 girls; mean age = 10.2 yr) participated in this pilot matched-pairs trial with random allocation and 6-mo follow-up (intervention, n = 7; control, n = 10). The intervention group received Sense training 3×/wk for 6 wk (18 hr). Outcome measures included Goal Attainment Scaling, Sense_assess(©) Kids, and the Assisting Hand Assessment.
RESULTS: The intervention group improved in goal performance, proprioception, and bimanual hand use and maintained improvement at 6-mo follow-up. The control group improved in occupational performance by 6-mo follow-up.
CONCLUSION: This study established the feasibility of using the Sense intervention in a pediatric setting and adds preliminary evidence to suggest that improving somatosensory function can improve motor function and goal performance among children with HCP.

DOI: 10.5014/ajot.2016.024968
PMID: 28422632

The impact of Kinesio taping technique on children with cerebral palsy.
Shamsoddini A, Rasti Z, Kalantari M, Hollisaz MT, Sobhani V, Dalvand H, Bakhshandeh-Bali MK.
Iran J Neurol. 2016 Oct 7;15(4):219-227.

Cerebral palsy (CP) is the most common movement disorder in children that is associated with life-long disability and multiple impairments. The clinical manifestations of CP vary among children. CP is accompanied by a wide range of problems and has a broad spectrum. Children with CP demonstrate poor fine and dross motor function due to psychomotor disturbances. Early rehabilitation programs are essential for children with CP and should be appropriate for the age and functional condition of the patients. Kinesio taping (KT) technique is a relatively new technique applied in rehabilitation programs of CP. This article reviews the effects of KT techniques on improving motor skills in children with CP. In this study, we used keywords "cerebral palsy, Kinesio Tape, KT and Taping" in the ational and international electronic databases between 1999 and 2016. Out of the 43 articles obtained, 21 studies met the inclusion criteria. There are several different applications about KT technique in children with CP. Review of the literature demonstrated that the impact of this technique on gross and fine motor function and dynamic activities is more effective than postural and static activities. Also this technique has more effectiveness in the child at higher developmental and motor stages. The majority of consistent findings showed that KT technique as part of a multimodal therapy program can be effective in the rehabilitation of children with CP to improve motor function and dynamic activities especially in higher developmental and motor stages.
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PMCID: PMC5392196
PMID: 28435631

Orthèses

An articulated ankle-foot orthosis with adjustable plantarflexion resistance, dorsiflexion resistance and alignment: A pilot study on mechanical properties and effects on stroke hemiparetic gait.
Kobayashi T, Orendurff MS, Hunt G, Lincoln LS, Gao F, LeCursi N, Foreman KB.
Med Eng Phys. 2017 Jun;44:94-101. doi: 10.1016/j.medengphy.2017.02.012. Epub 2017 Mar 9.

Mechanical properties of an articulated ankle-foot orthosis (AFO) are closely related to gait performance in individuals post-stroke. This paper presents a pilot study on the mechanical properties of a novel articulated AFO with adjustable plantarflexion resistance, dorsiflexion resistance and alignment, and its effect on ankle and knee joint kinematics and kinetics in an individual post-stroke during gait. The mechanical properties of the AFO were quantified. Gait analysis was performed using a 3D motion capture system with a split-belt instrumented treadmill under 12 different settings of the mechanical properties of the AFO [i.e. 4 plantarflexion resistances (P1<P4), 4 dorsiflexion resistances (D1<D4), 4 initial alignments (A1<A4)]. The AFO demonstrated systematic changes in moment-angle relationship in response to changes in AFO joint settings. The gait analysis demonstrated that the ankle and knee angle and moment were responsive to changes in the AFO joint settings. Mean ankle angle at initial contact changed from -0.86° (P1) to 0.91° (P4) and from -1.48° (A1) to 4.45° (A4), while mean peak dorsiflexion angle changed from 12.01° (D1) to 6.40° (D4) at mid-stance. The novel articulated AFO appeared effective in influencing lower-limb joint kinematics and kinetics of gait in the individual post-stroke.

DOI: 10.1016/j.medengphy.2017.02.012
PMCID: PMC5415412 [Available on 2018-06-01]
PMID: 28284572

Rationale for prescription, and effectiveness of, upper limb orthotic intervention for children with cerebral palsy: a systematic review.
Garbellini S, Robert Y, Randall M, Elliott C, Imms C.
Disabil Rehabil. 2017 Mar 12:1-11. doi: 10.1080/09638288.2017.1297498. [Epub ahead of print]

PURPOSE: To explore (i) reasons for upper limb orthosis prescription for children with cerebral palsy (CP), (ii) the link between reason and effect according to intended outcome and outcome measure utilized and (iii) to classify the prescribed orthoses using standard terminology.
METHOD: A prospectively registered (center for reviews and dissemination: 42015022067) systematic review searched for experimental and observational studies investigating rigid/thermoplastic upper limb orthotic intervention for children aged 0-18 with CP. The Cochrane central register, MEDLINE, CINAHL, Embase, SCOPUS and Web of Science databases were searched. Included studies were assessed for risk of bias.
RESULTS: Sixteen studies met selection criteria. Two studies described a specific reason for orthosis prescription, six prescribed orthoses to manage a clinical symptom and eight did not describe a reason. Eight studies were analyzed for effect according to intended outcome with no clear connection found between reasons for prescription, outcome measures utilized and effect reported.
INTERPRETATION: The lack of evidence for upper limb orthotic intervention for children with CP leads to uncertainty when considering this treatment modality. Future research is needed to evaluate the effect of orthosis wear in relation to intended outcome utilizing robust methods and valid and reliable outcome measures. Implications for rehabilitation: Insufficient evidence exists about the reason for prescription of upper limb orthoses. The connection between reason for orthosis prescription, intended outcome, outcome measure utilized and observed effect is unclear. Recommend orthosis prescription to be accompanied by clear documentation of the aim of the orthosis and description using orthosis classification system terminology. Outcome measures consistent with the reason for orthosis prescription and intended outcome of the intervention are essential to measure effectiveness of the intervention.
DOI: 10.1080/09638288.2017.1297498
PMID: 28286982

Robots – Exosquelette

Effects of dose and duration of robot-assisted gait training on walking ability of children affected by cerebral palsy.
Peri E, Turconi AC, Biffi E, Maghini C, Panzeri D, Morganti R, Pedrocchi A, Gagliardi C.
Technol Health Care. 2017 Apr 7. doi: 10.3233/THC-160668. [Epub ahead of print]

BACKGROUND: Robot-Assisted Gait Training (RAGT) is a widespread approach for locomotion rehabilitation but information about intervention frequency and duration is still lacking.
OBJECTIVE: To evaluate the effect of frequency and duration of a RAGT on motor outcome of children affected by Cerebral Palsy (CP).
METHODS: Forty-four CP children (age 4-17) underwent one among four different intensive trainings with equal dose of intervention, combining Task-Oriented Physiotherapy (TOP) and RAGT: 40 sessions (4 sessions/week) over 10 weeks of sole TOP (group1) or RAGT (group2) or RAGT and TOP (2 + 2 sessions/week; group3); 40 sessions in shorter period (4 weeks) of RAGT and TOP (5 + 5 sessions/week; group4). Each child was assessed before, after the training and after 3 months with: Ashworth, gross motor function measure (GMFM)-88, GMFM-66, six minutes walking test and gait analysis.
RESULTS: No differences among the 4 protocols were highlighted although both groups with exclusive physiotherapy and RAGT obtained significant improvements in GMFM-88, GMFM-E and GMFM-66 while the mixed approaches did not show significant changes.
CONCLUSION: Single-treatment approaches seem to be more effective than mixed approaches, independently from the duration (4 or 10 weeks). RAGT seems to have similar effect with respect to the traditional TOP, at least over 10 weeks.
DOI: 10.3233/THC-160668
PMID: 28436398

What does the literature say about using robots on children with disabilities?
Disabil Rehabil Assist Technol. 2017 Jul;12(5):429-440. doi: 10.1080/17483107.2017.1318308. Epub 2017 Apr 25.
Miguel Cruz A, Ríos Rincón AM, Rodríguez Dueñas WR, Quiroga Torres DA, Bohórquez-Heredia AF

PURPOSE: The purpose of this study is to examine the extent and type of robots used for the rehabilitation and education of children and young people with CP and ASD and the associated outcomes.

METHODS: The scholarly literature was systematically searched and analyzed. Articles were included if they reported the results of robots used or intended to be used for the rehabilitation and education of children and young people with CP and ASD during play and educative and social interaction activities.
RESULTS: We found 15 robotic systems reported in 34 studies that provided a low level of evidence. The outcomes were mainly for children with ASD interaction and who had a reduction in autistic behaviour, and for CP cognitive development, learning, and play.
CONCLUSION: More research is needed in this area using designs that provide higher validity. A centred design approach is needed for developing new low-cost robots for this population. Implications for rehabilitation In spite of the potential of robots to promote development in children with ASD and CP, the limited available evidence requires researchers to conduct studies with higher validity. The low level of evidence plus the need for specialized technical support should be considered critical factors before making the decision to purchase robots for use in treatment for children with CP and ASD. A user-entered design approach would increase the chances of success for robots to improve functional, learning, and educative outcomes in children with ASD and CP. We recommend that developers use this approach. The participation of interdisciplinary teams in the design, development, and implementation of new robotic systems is of extra value. We recommend the design and development of low-cost robotic systems to make robots more affordable.
DOI: 10.1080/17483107.2017.1318308
PMID: 28440095

Réalité virtuelle - Jeux video

A randomized controlled trial of web-based training to increase activity in children with cerebral palsy.
Mitchell LE, Ziviani J, Boyd RN.
Dev Med Child Neurol. 2016 Jul;58(7):767-73. doi: 10.1111/dmcn.13065. Epub 2016 Feb 15.

AIM: To determine the efficacy of web-based training on activity capacity and performance in children with unilateral cerebral palsy (CP).
METHOD: In a matched-pairs randomized waitlist controlled trial, independently ambulant children and adolescents with unilateral CP were allocated to receive 30 minutes of training (intervention) 6 days per week, or usual care (waitlist control) for 20 weeks. Activity capacity was assessed using maximal repetitions of functional strength tasks and 6-minute walk test (6MWT); performance using 4-day ActiGraph GT3X+ accelerometer records at baseline and 20 weeks. Data were analysed by intention to treat comparing between groups using hierarchical linear modelling.
RESULTS: Participants were n=101, 52 males, mean age 11 years 3 months (SD 2y 4mo). Intervention participants completed a mean 32.4 hours (SD 17.2) of training, associated with significant improvements in functional strength (mean difference 19.3 repetitions; 95% confidence interval [CI] 10.8-27.7; p<0.001) and 6MWT distance (mean difference 38.9m; 95% CI 12.3-51.9; p<0.001) compared with the control group at 20 weeks, although not activity performance (p>0.05).
INTERPRETATION: Training was effective at increasing functional strength and walking endurance in independently ambulant children with unilateral CP. This did not translate into improvements in activity performance.

DOI: 10.1111/dmcn.13065
PMID: 26877078 [Indexed for MEDLINE]

Active Video Gaming for Children with Cerebral Palsy: Does a Clinic-Based Virtual Reality Component Offer an Additive Benefit? A Pilot Study.
Levac D, McCormick A, Levin MF, Brien M, Mills R, Miller E, Sveistrup H.
Phs Occup Ther Pediatr. 2017 Apr 4:1-14. doi: 10.1080/01942638.2017.1287810. [Epub ahead of print]

AIMS: To compare changes in gross motor skills and functional mobility between ambulatory children with cerebral palsy who underwent a 1-week clinic-based virtual reality intervention (VR) followed by a 6-week, therapist-monitored home active video gaming (AVG) program and children who completed only the 6-week home AVG program.
METHODS: Pilot non-randomized controlled trial. Five children received 1 hour of VR training for 5 days followed by a 6-week home AVG program, supervised online by a physical therapist. Six children completed only the 6-week

home AVG program. The Gross Motor Function Measure Challenge Module (GMFM-CM) and Six Minute Walk Test (6MWT) evaluated change.
RESULTS: There were no significant differences between groups. The home AVG-only group demonstrated a statistically and clinically significant improvement in GMFM-CM scores following the 6-week AVG intervention (median difference 4.5 points, interquartile range [IQR] 4.75, p = 0.042). The VR + AVG group demonstrated a statistically and clinically significant decrease in 6MWT distance following the intervention (median decrease 68.2 m, IQR 39.7 m, p = 0.043). All 6MWT scores returned to baseline at 2 months post-intervention.
CONCLUSION: Neither intervention improved outcomes in this small sample. Online mechanisms to support therapist-child communication for exercise progression were insufficient to individualize exercise challenge.
DOI: 10.1080/01942638.2017.1287810
PMID: 28375682

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 [Indexed for MEDLINE]

Feasibility of Pediatric Game-Based Neurorehabilitation Using Telehealth Technologies: A Case Report.
Reifenberg G, Gabrosek G, Tanner K, Harpster K, Proffitt R, Persch A.
Am J Occup Ther. 2017 May/Jun;71(3):7103190040p1-7103190040p8. doi: 10.5014/ajot.2017.024976.

This case report is the first in a series of reports designed to determine the feasibility of implementing game-based neurorehabilitation using telehealth technologies (GbN+TT) for children with cerebral palsy, evaluate the responsiveness of relevant outcome measures to changes in motor impairment and activity participation after intervention, and identify technological challenges associated with implementation of GbN+TT. The participant completed more than 56 hr of game-based neurorehabilitation over 8 wk using the Timocco platform in his home. The primary measures of motor impairment (Bruininks-Oseretsky Test of Motor Proficiency, Second Edition) and function (Pediatric Motor Activity Log) were both sensitive to change. Results indicate that it is feasible to administer GbN+TT to a child with cerebral palsy and monitor outcomes using standardized assessments.

DOI: 10.5014/ajot.2017.024976
PMID: 28422630

Thérapies cellulaires

Effect of Intravenous Infusion of G-CSF-Mobilized Peripheral Blood MononuclearCells on Upper Extremity Function in Cerebral Palsy Children.

Park KI, Lee YH, Rah WJ, Jo SH, Park SB, Han SH, Koh H, Suh JY, Um JS, Choi EH, Park UJ, Kim MJ
Ann Rehabil Med. 2017 Feb;41(1):113-120. doi: 10.5535/arm.2017.41.1.113. Epub2017 Feb 28.

OBJECTIVE: To investigate the effect of intravenous infusion of peripheral blood mononuclear cells (mPBMC) mobilized by granulocyte-colony stimulating factor (G-CSF) on upper extremity function in children with cerebral palsy (CP).
METHODS: Fifty-seven children with CP were enrolled. Ten patients were excluded due to follow-up loss. In total, 47 patients (30 males and 17 females) were analyzed. All patients' parents provided signed consent before the start of the study. After administration of G-CSF for 5 days, mPBMC was collected and cryopreserved. Patients were randomized into two groups 1 month later. Twenty-two patients were administered mPBMC and 25 patients received normal saline as placebo. Six months later, the two groups were switched, and administered mPBMC and placebo, respectively. Quality of Upper Extremity Skills Test (QUEST) and the Manual Ability Classification System (MACS) were used to evaluate upper motor function.
RESULTS: All subdomain and total scores of QUEST were significantly improved after mPBMC and placebo infusion, without significant differences between mPBMC and placebo groups. A month after G-CSF, all subdomain and total scores of QUEST were improved. The level of MACS remained unchanged in both mPBMC and placebo groups.
CONCLUSION: In this study, intravenously infused mPBMC showed no significant effect on upper extremity function in children with CP, as compared to placebo. The effect of mPBMC was likely masked by the effect of G-CSF, which was used in both groups and/or G-CSF itself might have other neurotrophic potentials in children with CP.
Free PMC Article
DOI: 10.5535/arm.2017.41.1.113
PMCID: PMC5344812
PMID: 28289643
Conflict of interest statement: CONFLICT OF INTEREST: No potential conflict of interest relevant to this article was reported.

Induction of Neurorestoration From Endogenous Stem Cells.
Yu JH, Seo JH, Lee JY, Lee MY, Cho SR.
Cell Transplant. 2016;25(5):863-82. doi: 10.3727/096368916X690511. Epub 2016 Jan 18.

Neural stem cells (NSCs) persist in the subventricular zone lining the ventricles of the adult brain. The resident stem/progenitor cells can be stimulated in vivo by neurotrophic factors, hematopoietic growth factors, magnetic stimulation, and/or physical exercise. In both animals and humans, the differentiation and survival of neurons arising from the subventricular zone may also be regulated by the trophic factors. Since stem/progenitor cells present in the adult brain and the production of new neurons occurs at specific sites, there is a possibility for the treatment of incurable neurological diseases. It might be feasible to induce neurogenesis, which would be particularly efficacious in the treatment of striatal neurodegenerative conditions such as Huntington's disease, as well as cerebrovascular diseases such as ischemic stroke and cerebral palsy, conditions that are widely seen in the clinics. Understanding of the molecular control of endogenous NSC activation and progenitor cell mobilization will likely provide many new opportunities as therapeutic strategies. In this review, we focus on endogenous stem/progenitor cell activation that occurs in response to exogenous factors including neurotrophic factors, hematopoietic growth factors, magnetic stimulation, and an enriched environment. Taken together, these findings suggest the possibility that functional brain repair through induced neurorestoration from endogenous stem cells may soon be a clinical reality.
DOI: 10.3727/096368916X690511
PMID: 26787093 [Indexed for MEDLINE]

Outcomes of autologous bone marrow mononuclear cells for cerebral palsy: an open label uncontrolled clinical trial.
Nguyen LT, Nguyen AT, Vu CD, Ngo DV, Bui AV.
BMC Pediatr. 2017 Apr 12;17:104. doi: 10.1186/s12887-017-0859-z.

BACKGROUND: Stem cell therapy has emerged as a promising method for improving motor function of patients with cerebral palsy. The aim of this study is to assess the safety and effectiveness of autologous bone marrow mononuclear stem cell transplantation in patients with cerebral palsy related to oxygen deprivation.

METHODS: An open label uncontrolled clinical trial was carried out at Vinmec International Hospital. The intervention consisted of two administrations of stem cells, the first at baseline and the second 3 months later. Improvement was monitored at 3 months and 6 months after the first administration of stem cells, using the Gross Motor Function Measure (GMFM) and Modified Ashworth Score which measures muscle tone.
RESULTS: No severe complications were recorded during the study. After transplantation, 12 patients encountered fever without infections and 9 patients experienced vomiting which was easily managed with medications. Gross motor function was markedly improved 3 months or 6 months after stem cell transplantation than at baseline. The post-transplantation GMFM-88 total score, each of its domains and the GMFM-66 percentile were all significantly higher (p-value < 0.001). Muscle spasticity also reduced significantly after transplantation (p-value < 0.001). The therapy was equally effective regardless of sex, age and GMFCS level (p-value > 0.05).
CONCLUSION: Autologous bone marrow mononuclear cell transplantation appears to be a safe and effective therapy for patients with cerebral palsy.
TRIAL REGISTRATION: ClinicalTrials.gov Identifier: NCT02569775 . Retrospectively registered on October 15, 2015.
Free PMC Article
DOI: 10.1186/s12887-017-0859-z
PMCID: PMC5389089
PMID: 28403842

Autres

Complementary traditional Chinese medicine use in Children with cerebral palsy: a nationwide retrospective cohort study in Taiwan.
Liao HH, Yen HR, Muo CH, Lee YC, Wu MY, Chou LW(8,)(9), Sun MF, Chang TT
BMC Complement Altern Med. 2017 Mar 14;17(1):155. doi: 10.1186/s12906-017-1668-5.

BACKGROUND: Complementary traditional Chinese medicine (TCM) has been used to treat patients with cerebral palsy (CP). However, large-scale surveys examining its use in the treatment of CP and associated disorders are lacking.
METHODS: We enrolled 11,218 patients ≤ 18 years of age with CP in the Taiwanese National Health Insurance Research Database from 1995 to 2011. Patients were categorized as TCM users (n = 6,997; 62.37%) and non-TCM users (n = 4,221; 37.63%) based on the inclusion of TCM in their treatment plan.
RESULTS: Children with higher proportions of complementary TCM use were male, younger, and lived in urbanized areas. Most TCM users (n = 5332, 76.2%) visited TCM outpatient departments more than 20 times per year. In both groups, the three most common reasons for clinical visits were problems of the nervous system, respiratory system, and digestive system. Acupuncture was commonly used in problems of injury, musculoskeletal system and connective tissue, and nervous system. Chinese herbal medicine was used to improve the primary symptoms of CP in patients, as well as its associated disorders. The incidence rate ratios in allergic rhinitis, dyspepsia, menstrual disorders, and musculoskeletal system and connective tissue diseases among TCM users were significantly higher than non-TCM users. Although patients receiving complementary TCM therapies had higher medical expenditure for utilizing outpatient clinical consultations, their medical costs for visiting ER and hospitalization were significantly lower than that of non-TCM user within one year of the diagnosis of CP.
CONCLUSION: This study was a large-scale survey to characterize patterns of complementary TCM use among children with CP. The complementary use of TCM in children with CP was considerably high. Future clinical trials and basic researches can be developed based on the findings of this study.
Free PMC Article
DOI: 10.1186/s12906-017-1668-5
PMCID: PMC5348761
PMID: 28288600 [Indexed for

Different horse's paces during hippotherapy on spatio-temporal parameters of gait in children with bilateral spastic cerebral palsy: A feasibility study.
Antunes FN, Pinho AS, Kleiner AF, Salazar AP, Eltz GD, de Oliveira Junior AA, Cechetti F, Galli M, Pagnussat AS.
Res Dev Disabil. 2016 Dec;59:65-72. doi: 10.1016/j.ridd.2016.07.015. Epub 2016 Aug 9.

Hippotherapy is often carried out for the rehabilitation of children with Cerebral Palsy (CP), with the horse riding at a walking pace. This study aimed to explore the immediate effects of a hippotherapy protocol using a walk-trot pace on spatio-temporal gait parameters and muscle tone in children with Bilateral Spastic CP (BS-CP). Ten children diagnosed with BS-CP and 10 healthy aged-matched children (reference group) took part in this study. The children with BS-CP underwent two sessions of hippotherapy for one week of washout between them. Two protocols (lasting 30min) were applied on separate days: Protocol 1: the horse's pace was a walking pace; and Protocol 2: the horse's pace was a walk-trot pace. Children from the reference group were not subjected to treatment. A wireless inertial measurement unit measured gait spatio-temporal parameters before and after each session. The Modified Ashworth Scale was applied for muscle tone measurement of hip adductors. The participants underwent the gait assessment on a path with surface irregularities (ecological context). The comparisons between BS-CP and the reference group found differences in all spatio-temporal parameters, except for gait velocity. Within-group analysis of children with BS-CP showed that the swing phase did not change after the walk pace and after the walk-trot pace. The percentage of rolling phase and double support improved after the walk-trot. The spasticity of the hip adductors was significantly reduced as an immediate result of both protocols, but this decrease was more evident after the walk-trot. The walk-trot protocol is feasible and is able to induce an immediate effect that improves the gait spatio-temporal parameters and the hip adductors spasticity.

DOI: 10.1016/j.ridd.2016.07.015
PMID: 27518920 [Indexed for MEDLINE]

Family Dog-Assisted Adapted Physical Activity: A Case Study.
Tepfer A, Ross S, MacDonald M, Udell MAR, Ruaux C, Baltzer W.
Animals (Basel). 2017 Apr 27;7(5). pii: E35. doi: 10.3390/ani7050035.

Purpose: The aim of this case study was to examine the individual effects of an adapted physical activity, animal-assisted intervention (APA-AAI) with the family dog on motor skills, physical activity, and quality of life of a child with cerebral palsy (CP).
Method: This study used an A-B-A single-subject design. The assessment phase (phase A) occurred pre- and post-intervention. This consisted of standardized assessments of motor skills, quality of life questionnaires, physical activity (measured using the GT3X+ accelerometer) and the human-animal bond. The intervention (phase B) lasted 8 weeks and consisted of adapted physical activities performed with the family dog once a week for 60 min in a lab setting. In addition, the participant had at-home daily activities to complete with the family dog.
Results: Visual analysis was used to analyze the data. Motor skill performance, physical activity, quality of life and human animal interaction gains were observed in each case.
Conclusions: These preliminary results provided initial evidence that the family-dog can play a role in healthy lifestyles
through APA-AAI in children with CP.
DOI: 10.3390/ani7050035
PMID: 28448430

Douleur

Musculoskeletal system pain and related factors in mothers of children with cerebral palsy.
Terzi R, Tan G.
Agri. 2016 Jan;28(1):18-24. doi: 10.5505/agri.2015.74436.

OBJECTIVES: The aim of the present study was to identify prevalence of musculoskeletal system diseases and related factors among mothers of children with cerebral palsy.
METHODS: Eighty-five mothers of children with cerebral palsy were included as the treatment group, and 42 mothers of healthy children were included as the control group. Sociodemographic characteristics of all subjects were recorded. Musculoskeletal system pain was evaluated by the standardized Nordic Musculoskeletal Questionnaire, and level of depression was evaluated according to Beck's Depression Scale.
RESULTS: Musculoskeletal system pain and depression scores of the treatment group were significantly higher than those of the control group. Most frequently reported by mothers in the treatment group was low back pain (44.7%).

In multiple regression analysis, number of children, age, and functional level of the child with cerebral palsy, as well as depression level of the mother were identified as independent risk factors for musculoskeletal system pain.
CONCLUSION: Mothers of children with cerebral palsy are at higher risk for musculoskeletal system pain and depression. Prevalence of musculoskeletal system pain in these mothers, especially those with older children who have lower functional statuses, should be kept in mind.
PMID: 27225608 [Indexed for MEDLINE]

Autres Troubles / Troubles concomitants

Troubles respiratoires

Simultaneous Measurement of Breathing Kinematics and Surface Electromyography of Chest Wall Muscles during Maximum Performance and Speech Tasks in Children: Methodological Considerations.
Clair-Auger JM, Gan LS, Norton JA, Boliek CA.
Folia Phoniatr Logop. 2015;67:202-11. doi: 10.1159/000441326. Epub 2016 Jan 16.

OBJECTIVE: To develop a standardized paediatric protocol for acquiring simultaneous chest wall kinematics and surface electromyography (EMG) of chest wall muscles during maximum performance and speech tasks.
PATIENTS AND METHODS: Eighteen healthy participants included: (a) a younger age group (n = 6; ages 4.0-6.5 years), (b) an older age group (n = 6; ages 7.0-10.5 years), and (c) an adult group (n = 8; ages 21-33 years). A child (age 10 years) with spastic-type cerebral palsy (CP) served as a 'proof of protocol feasibility'. Chest wall kinematics and surface EMGs (intercostals, rectus abdominus, external oblique, latissimus dorsi, and erector spinae) were acquired during maximum performance and speech tasks.
RESULTS: Successful calibration of the EMG signal and reliable detection of muscle activation onset, offset, and amplitude relative to vital capacity and percent maximum voluntary contraction in children were demonstrated. Kinematic and surface EMG measurements were sensitive to non-speech and speech tasks, age, and neurological status (i.e. CP).
CONCLUSION: The simultaneous measurement of kinematics and EMG of the chest wall muscle groups provides a more comprehensive description of speech breathing in children. This protocol can be used for the observation and interpretation of clinical outcomes seen in children with motor speech disorders following treatments that focus on increasing overall respiratory and vocal effort.

DOI: 10.1159/000441326
PMID: 26771452 [Indexed for MEDLINE]

Troubles urinaires

Cross-sectional study of urinary problems in adults with cerebral palsy: awareness and impact on the quality of life.
Yıldız N, Akkoç Y, Ersöz M, Gündüz B, Erhan B, Yesil H, Bardak AN, Ozdolap S, Tunç H, Koklu K, Alemdaroğlu E, Erden E, Sungur U, Satır O, Erdogan C, Alkan H.
Neurol Sci. 2017 Apr 7. doi: 10.1007/s10072-017-2948-z. [Epub ahead of print]

We aimed to assess the functional status, urinary problems, and awareness of these problems in adults with cerebral palsy (CP) and their relationship with the quality of life. One-hundred-seventeen adults with CP (53 women, 64 men) were included in this study. Subjects were asked to fill out a urological questionnaire which dealt with urinary symptoms, awareness of urinary problems, and pharmacological treatment they received. Subjects were also assessed with the Gross Motor Function Classification System (GMFCS), Functional Independence Measures (FIM), Functional Mobility Scale (FMS), and King's Health Questionnaire (KHQ). The mean age of the subjects was 25.3 ± 7.8 years. Of the patients, 83.8% were currently unemployed, 95.7% were single, and 96.5% were living with family. Of the patients, 20.5% had experienced frequency, 38.5% had nocturia, 48.7% had urgency, and 36.8% had urge urinary incontinence. Approximately 80% of the patients did not refer to physician due to urinary problems, and 60% of patients were not recorded history about urinary problem by any physician. Urge urinary incontinence was statistically more frequent in females than males (54.7 and 21.9%,respectively, $p < 0.05$).Female patients had significantly higher KHQ incontinence impact, role limitation, physical limitation, emotion, incontinence severity

measures, and symptom severity subgroup scores than male patients ($p < 0.05$). Urge urinary incontinence was most frequent (65.4%) in spastic quadriplegic CP ($p < 0.05$). All functional status scores (GMFCS, FIM-toilet transfer, and FMSs) were worse in spastic quadriplegic patients than other topographical involvement of CP ($p < 0.0125$). Although the urinary problems are common in adult with CP, it is yet an overlooked condition that could affect quality of life. Therefore, health care professionals, patients, and their caregivers should be aware of the increased risk of urinary problems in these patients.
DOI: 10.1007/s10072-017-2948-z
PMID: 28389939

Troubles musculosquelettiques, des tissus conjonctifs et osseux

Bone mineral density and insulin-like growth factor-1 in children with spastic cerebral palsy.
Nazif H, Shatla R, Elsayed R, Tawfik E, Osman N, Korra S, Ibrahim A.
Childs Nerv Syst. 2017 Apr;33(4):625-630. doi: 10.1007/s00381-017-3346-9. Epub 2017 Feb 24.

BACKGROUND: Children with cerebral palsy (CP) have significant decrease linear growth rate and low bone mineral density (BMD).
AIMS: This study is to evaluate BMD in children with CP and its relation to the levels of insulin-like growth factor-1 (IGF-1).
SUBJECTS AND METHODS: This cross-sectional study was carried out on 58 children suffering from spastic CP with the age range 4-12 years compared to 19 controls. All assessed by dual energy x-ray absorptiometry (DXA) to measure BMD, serum level of IGF-1, and serum vitamin D. The patients were classified according to their GMFCS.
RESULTS: Fractures were reported in seven (12.1%) of cases. Our study demonstrated that, IGF-1 level and BMD decrease in correlation with the severity of CP. IGF-1correlates positively with serum vitamin D, BMI, and BMD. CP children with severe GMFCS level or who use anticonvulsive drugs are at a high risk for low BMD and low levels of IGF-1.
CONCLUSION: Both BMD and IGF-1 were significantly in low children with spastic CP; IGF-1 negatively correlates with the severity of osteopenia in children with spastic. Children with CP who are not independently ambulant or with severe GMFCS level or who use anticonvulsive drugs are at a high risk for developing low BMD.
DOI: 10.1007/s00381-017-3346-9
PMID: 28236062 [Indexed for MEDLINE]

Bone mineral density and vitamin D status in children with epilepsy, cerebral palsy, and cerebral palsy with epilepsy.
Childs Nerv Syst. 2017 Jan;33(1):153-158. doi: 10.1007/s00381-016-3258-0. Epub 2016 Oct 18.
Tosun A, Erisen Karaca S, Unuvar T, Yurekli Y(4), Yenisey C, Omurlu IK.

PURPOSE: We aimed to evaluate the relationship between bone mineral density (BMD) disorders and possible risk factors in patients with epilepsy only (EO), cerebral palsy only (CPO), and cerebral palsy-epilepsy (CP + E).
METHODS: A total of 122 patients [EO (n = 54), CPO (n = 30), CP + E (n = 38)] and 30 healthy children were evaluated. BMD was only measured in patient groups, not in control subjects. BMD of lumbar vertebrae was determined by dual energy X-ray absorptiometry (DXA). An abnormal BMD was defined as low or low normal BMD.
RESULTS: Low BMD rate in EO, CPO, and CP + E group was 3.7, 50, and 39.5 %, respectively. Abnormal BMD values were significantly related to inadequate dietary Ca intake ($p = 0.017$), severe intellectual disability ($p < 0.001$), and immobility ($p = 0.018$). In multivariate regression analysis, the risk of abnormal BMD was higher (3.9-fold) in patients not able to walk independently than the others ($p = 0.029$). However, serum Ca-Vitamin D levels, insufficient exposure to sunlight, low BMI, and use of AED were not correlated with abnormal BMD.
CONCLUSION: Abnormal BMD is a common problem in patients with CP and CP + E. Abnormal BMD was related to the severity of CP, but not to vitamin D levels or AED treatment.
DOI: 10.1007/s00381-016-3258-0
PMID: 27757568 [Indexed for MEDLINE]

The functional muscle-bone unit in children with cerebral palsy.
Duran I, Schütz F, Hamacher S, Semler O, Stark C, Schulze J, Rittweger J, Schoenau E
Osteoporos Int. 2017 Apr 1. doi: 10.1007/s00198-017-4023-2. [Epub ahead of print]

Our results suggest that the prevalence of bone health deficits in children with CP was overestimated, when using only age- and height-adjusted bone mineral content (BMC) and areal bone mineral density (aBMD). When applying the functional muscle-bone unit diagnostic algorithm (FMBU-A), the prevalence of positive results decreased significantly. We recommend applying the FMBU-A when assessing bone health in children with CP.
INTRODUCTION: The prevalence of bone healthndeficits in children with cerebral palsy (CP) might be overestimated because age-and height-adjusted reference percentiles for bone mineral content (BMC) and areal bone mineral density (aBMD) assessed by dual-energy X-ray absorptiometry (DXA) do not consider reduced muscle activity. The aim of this study was to compare the prevalence of positive DXA-based indicators for bone health deficits in children with CP to the prevalence of positive findings after applying a functional muscle-bone unit diagnostic algorithm (FMBU-A) considering reduced muscle activity.
METHODS: The present study was a monocentric retrospective analysis of 297 whole body DXA scans of children with CP. The prevalence of positive results of age-and height-adjusted BMC and aBMD defined as BMC and aBMD below the P3 percentile and of the FMBU-A was calculated.
RESULTS: In children with CP, the prevalence of positive results of age-adjusted BMC were 33.3% and of aBMD 50.8%. Height-adjusted results for BMC and aBMD were positive in 16.8 and 36.0% of cases. The prevalence of positive results applying the FMBU-A regarding BMC and aBMD were significantly ($p < 0.001$) lower than using age- and height-adjusted BMC and aBMD (8.8 and 14.8%).
CONCLUSIONS: Our results suggest that the prevalence of bone health deficits in children with CP was overestimated, when using age- and height-adjusted BMC and aBMD. When applying the FMBU-A, the prevalence decreased significantly. We recommend applying the FMBU-A when assessing bone health in children with CP.
DOI: 10.1007/s00198-017-4023-2
PMID: 28365851

Troubles sensoriels

Perspectives on tactile intervention for children with cerebral palsy: a framework to guide clinical reasoning and future research.
Auld ML, Johnston LM.
Disabil Rehabil. 2017 Apr 14:1-6. doi: 10.1080/09638288.2017.1312571. [Epub ahead of print]

PURPOSE: Many children with cerebral palsy (CP) are known to experience tactile impairments. Research evaluating specific interventions to manage this is, however, minimal. This paper seeks to consolidate current literature and provide a framework to help clinicians and researchers think strategically about tactile treatment selection and future research planning.
METHOD: The framework is described via a novel analogy - "The Apartment Block Theory". The theory describes the relative effectiveness of three intervention strategies aimed at overcoming a poorly responsive tactile system: (1) Pressing the buzzer - providing repeated passive tactile stimulation at the periphery; (2) Sneaking in the door - providing active tactile-enhanced motor training that capitalises on the opportunity to provide high-dose tactile input during motor interventions; and Connecting another way - providing visually enhanced touch strategies with the aim of enhancing tactile function, which can be compared to phoning the apartment as an alternative to using the buzzer.
RESULTS: Using this theory, the paper describes which sub-groups of children with CP may benefit from each intervention strategy when considering their capabilities in visual, motor, and attention domains.
CONCLUSIONS: This theory can assist clinicians to provide effective interventions and researchers to make informed future research decisions to optimise tactile function for children with CP. Implications for Rehabilitation Although tactile impairments are reported to be common in children with cerebral palsy, very few successful interventions are reported in the literature. Visually enhanced touch is a successful strategy for treating tactile impairments in children with cerebral palsy who have sufficient vision and attention. Combining intentional tactile input with upper limb movement training may improve tactile function in children with cerebral palsy who have sufficient movement and attention. In children who have complex co-morbidities, including both visual and movement impairments, it may be necessary to consider providing passive tactile stimulation in tactile intervention.
DOI: 10.1080/09638288.2017.1312571
PMID: 28407718

Nutrition – Troubles nutritionnels - Métabolisme

Energy cost during walking in association with age and body height in children and young adults with cerebral palsy.
Bolster EAM, Balemans ACJ, Brehm MA, Buizer AI, Dallmeijer AJ.
Gait Posture. 2017 Feb 27;54:119-126. doi: 10.1016/j.gaitpost.2017.02.026. [Epub ahead of print]

AIM: This cross-sectional study into children and young adults with cerebral palsy (CP) aimed to assess the association of gross energy cost (EC), net EC and net nondimensional (NN) EC during walking with age and body height, compared to typically developing (TD) peers.
METHOD: Data was collected in 128 participants with CP (mean age 11y9mo; GMFCS I,n=48; II,n=56; III, n=24) and in 63 TD peers (mean age 12y5mo). Energy cost was assessed by measuring the oxygen consumption during over-ground walking at comfortable speed. Outcome measures derived from the assessment included the gross and net EC, and NN EC. Differences between the groups in the association between gross, net and NN EC with age and body height, were investigated with regression analyses and interaction effects ($p<0.05$).
RESULTS: Interaction effects for age and body height by group were not significant, indicating similar associations for gross, net and NN EC with age or body height among groups. The models showed a significant decline for gross, net and NN EC with increasing age per year (respectively -0.201Jkg(-1)m(-1); -0.073Jkg(-1)m(-1); -0.007) and body height per cm (respectively -0.057Jkg(-1)m(-1); -0.021Jkg(-1)m(-1); -0.002).
INTERPRETATION: Despite higher gross and net EC values for CP compared to TD participants , similar declines in EC outcomes can be expected with growth for participants aged 4-22 years with CP. All energy cost outcomes showed a decline with growth, indicating that correcting for this decline is required when evaluating changes in gross EC, and, to a lesser extent, in net and NN EC in response to treatment or from natural course over time.

DOI: 10.1016/j.gaitpost.2017.02.026
PMID: 28288332

Serum Leptin as a Nutritional Biomarker in Children with Cerebral Palsy.
Amarase C, Weerasopone S, Osateerakun P, Honsawek S, Limpaphayom N.
Tohoku J Exp Med. 2016;239(2):139-46. doi: 10.1620/tjem.239.139.

Adequate nutrition is crucial for children with cerebral palsy (CCP). However, conventional nutritional assessments may be inadequate for defining undernourished CCP. Leptin, an adipocyte hormone controlling energy expenditure, could be a useful marker. Objectives of this cross-sectional analytic study were to explore correlations between serum leptin level and nutritional status, anthropometric measurements, and biochemical parameters in 86 CCP (aged 9 ± 2 years). Subscapular (SST) and triceps (TST) skinfold thicknesses, weight, and calculated height were obtained. Body mass index and weight-for-height (WH) Z-scores were calculated. Complete blood count and serum levels of leptin and albumin were collected. CCP were classified as undernourished if their WHZ was < -2 according to the World Health Organization criteria. Correlations between anthropometric measurements, biochemical data, and serum leptin levels were evaluated. From 86 CCP, 11 (12%) children were undernourished, and SST, hemoglobin, and hematocrit were significantly lower. Serum leptin levels of nourished and undernourished CCP were 5.4 ± 6.2 and 2.9 ± 1.6 ng/mL ($p < 0.001$), while the reported value from normal children was 4.9 ng/mL. Serum leptin levels demonstrated a significant correlation with SST and TST ($r = 0.83$ and 0.72; $p < 0.001$). Serum leptin was the only marker significantly correlated with WHZ ($r = 0.45$, $p < 0.001$) while adjusting for covariates. A serum leptin level of 2.2 ng/mL was the optimal cutoff point for defining adequate nutritional status (WHZ ≥ -2). The measurement of serum leptin should be included in a care scheme of CCP especially during surgical evaluation.
Free Article
DOI: 10.1620/tjem.239.139
PMID: 27265160 [Indexed for MEDLINE]

Sphère bucco-dentaire – Troubles de la déglutition

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. 2017 Feb;32:22-29. doi: 10.1016/j.jelekin.2016.11.005. Epub 2016 Nov 29.

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 [Indexed for MEDLINE]

Pediatric Oral Motor Feeding Assessments: A Systematic Review.
Barton C, Bickell M, Fucile S.
Phys Occup Ther Pediatr. 2017 Apr 21:1-20. doi: 10.1080/01942638.2017.1290734. [Epub ahead of print]

AIM: To describe the clinical properties and psychometric soundness of pediatric oral motor feeding assessments.
METHODS: A systematic search was conducted using Medline, CINAHL, EMBASE, PsycInfo, and HAPI databases. Assessments were analyzed for their clinical and psychometric characteristics.
RESULTS: 12 assessment tools were identified to meet the inclusion/exclusion criteria. Clinical properties varied from assessments evaluating oral-motor deficits, screening to identify feeding problems, and monitoring feeding progress. Most assessments were designed for children with developmental disabilities or cerebral palsy. Eleven assessments had psychometric evidence, of these nine had reliability and validity testing (Ability for Basic Feeding and Swallowing Scale for Children, Behavioral Assessment Scale of Oral Functions in Feeding, Dysphagia Disorder Survey, Functional Feeding Assessment-modified, Gisel Video Assessment, Montreal Children's Hospital Feeding Scale, Oral Motor Assessment Scale, Schedule for Oral Motor Assessment, and Screening Tool of Feeding Problems Applied to Children). The Brief Assessment of Motor Function-Oral Motor Deglutition and the Pediatric Assessment Scale for Severe Feeding Problems had reliability testing only. The Slurp Test was not tested for any psychometric properties. Overall, psychometric evidence was inconsistent and inadequate for the evaluative tools.
DOI: 10.1080/01942638.2017.1290734
PMID: 28430014

The impact of submandibular duct relocation on drooling and the well-being of children with neurodevelopmental disabilities.
Kok SE, van der Burg JJ, van Hulst K, Erasmus CE, van den Hoogen FJ.
Int J Pediatr Otorhinolaryngol. 2016 Sep;88:173-8. doi: 10.1016/j.ijporl.2016.06.043. Epub 2016 Jun 28.

OBJECTIVE: The aim of this study was to evaluate the impact of a reduction in drooling after bilateral submandibular duct relocation (SMDR) with sublingual gland excision on daily life and care, as well as social and emotional consequences in children and adolescents with neurodevelopmental disabilities.
METHODS: This prospective cohort study included 72 children and adolescents (46 males, 26 females) with moderate to severe drooling, and their caregivers. Mean age at the time of surgery was 15 years 2 months (SD 4y 3mo). Fifty-two children were diagnosed with cerebral palsy and 20 had other non-progressive developmental disabilities. A caregiver questionnaire to document the impact of drooling on daily care and economic consequences, social interaction and emotional development and self-esteem was administered before, and 8 and 32 weeks after surgery.
RESULTS: Following bilateral SMDR the mean Visual Analogue Scale (VAS, 0-100) scores demonstrated a significant ($p < 0.001$) reduction in the severity of drooling from 81 at baseline to 28 and 36 after 8 and 32 weeks, respectively.

This was accompanied by a decrease in the amount of daily care required and reduced economic consequences. In addition, an increase in social contact with other children and adults was reported by caregivers after surgery.
CONCLUSION: Bilateral SMDR with sublingual gland excision provides a significant positive reduction in daily care of children suffering from drooling. Caregivers also report positive changes in their child's social interaction and sense of self-esteem.

DOI: 10.1016/j.ijporl.2016.06.043
PMID: 27497408 [Indexed for MEDLINE]

Troubles visuels

Setting up of a cerebral visual impairment clinic for children: Challenges and future developments.
Philip SS.
Indian J Ophthalmol. 2017 Jan;65(1):30-34. doi: 10.4103/0301-4738.202303.

AIM: The aim of this study is to describe the setting up of a cerebral visual impairment (CVI) clinic in a tertiary care hospital in South India and to describe the spectrum of cases seen.
MATERIALS AND METHODS: The CVI clinic, set up in February 2011, receives interdisciplinary input from a core team involving a pediatrician, neurologist, psychiatrist, occupational therapist, pediatric ophthalmologist, and an optometrist. All children, <18 years of age, with cerebral palsy (CP), learning disability, autism, neurodegenerative diseases, and brain trauma are referred to the clinic for functional vision assessment and opinion for further management.
RESULTS: One thousand four hundred and seventy-eight patients were seen in the CVI clinic from February 2011 to September 2015. Eighty-five percent of the patients were from different parts of India. In the clinic, 61% had CP, 28% had seizure disorders, autism was seen in 9.5%, and learning disability, neurodegenerative conditions, and brain injury together constituted 1.5%. Most of the children (45%) had moderate CP. Forty percent of CVI was due to birth asphyxia, but about 20% did not have any known cause for CVI. Seventy percent of patients, who came back for follow-up, were carrying out the habilitation strategies suggested.
CONCLUSIONS: Average attendance of over 300 new patients a year suggests a definite need for CVI clinics in the country. These children need specialized care to handle their complex needs. Although difficult to coordinate, an interdisciplinary team including the support groups and voluntary organizations is needed to facilitate the successful implementation of such specialized service.
Free PMC Article
DOI: 10.4103/0301-4738.202303
PMCID: PMC5369290
PMID: 28300737

Troubles du spectre autistique

Prevalence and characteristics of autism spectrum disorders in children with cerebral palsy.
Delobel-Ayoub M, Klapouszczak D, van Bakel MME, Horridge K, Sigurdardottir S, Himmelmann K, Arnaud C.
Dev Med Child Neurol. 2017 Apr 25. doi: 10.1111/dmcn.13436. [Epub ahead of print]

AIM: To evaluate the prevalence of co-occurring autism spectrum disorders (ASDs) among children with cerebral palsy (CP), and to describe their characteristics.
METHOD: The data of 1225 CP cases from four population-based registers (Iceland, Sweden, and two in France) and one population-based surveillance programme (North East England, UK) participating in the Surveillance of Cerebral Palsy in Europe Network (SCPE) were analysed. The ASD diagnoses were systematically recorded using category F84 of the International Classification of Diseases, 10th Revision. The registers provided data on children born between 1995 and 2006, while the cross-sectional survey in the UK concerned children aged 0 to 19 years, registered in 2010.
RESULTS: Among the children with CP, 107 had an associated diagnosis of ASD - i.e., 8.7% of the study population (95% confidence interval 7.2-10.5). This proportion varied across centres from 4.0% to 16.7% but was independent of CP prevalence. Male sex, co-occurring epilepsy, intellectual disability, and better walking ability were associated with the coexistence of ASD.

INTERPRETATION: Our findings support the need for a multidisciplinary approach to management of children with CP to adequately identify and address all facets of presentation, including ASD.

DOI: 10.1111/dmcn.13436
PMID: 28439889

Reproduction Obstétrique

Reproductive healthcare experiences of women with cerebral palsy.
Hayward K, Chen AY, Forbes E, Byrne R, Greenberg MB, Fowler EG.
Disabil Health J. 2017 Apr 5. pii: S1936-6574(17)30063-8. doi: 10.1016/j.dhjo.2017.03.015. [Epub ahead of print]

BACKGROUND: Little is known about pregnancy rates in women with disabilities in general and even less is known about women with child-onset disabilities such as cerebral palsy (CP).
HYPOTHESIS: We hypothesized that discussions about pregnancy with healthcare providers and pregnancy rates for woman with CP would be related to their functional levels.
METHODS: Survey methodology was used to gather information about demographics, function, whether women were asked about their desire for children, pregnancy outcomes, and services offered during pregnancy and postpartum.
RESULTS: Of the 375 women with CP who participated in the survey, 76 (20%) reported 149 pregnancies resulting in 100 live births. Using Chi square statistics, mobility, manual dexterity, and communication function were significantly higher in women who were queried about or who experienced pregnancy. More than half of the women experienced a loss of mobility during pregnancy but few received referrals for physical or occupational therapy. Few reported screening for postpartum depression. A higher rate of Cesarean sections (50.4%), preterm births (12.1%), low birth weight infants (15.7%), and very low birth weight infants (7.1%) was reported by women with CP compared to national statistics.
CONCLUSIONS: Pregnancy rates and discussions were related to functional levels. As 20% of women with CP surveyed experienced pregnancy, there is a need to increase awareness, education, support, and advocacy for achievement of optimal reproductive health. More research is needed to identify factors contributing to maternal and infant health in women with CP.

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Qualité de vie et rapport au monde

Qualité de vie – Retentissement dans la vie quotidienne

Describing heterogeneity of unmet needs among adults with a developmental disability: An examination of the 2012 Canadian Survey on Disability.
Zwicker J, Zaresani A, Emery JCH
Res Dev Disabil. 2017 Apr 13;65:1-11. doi: 10.1016/j.ridd.2017.04.003. [Epub ahead of print]

BACKGROUND: As a signatory to the UN Convention on the Rights of Persons with Disabilities, Canada has committed to protect the rights and dignity of persons with developmental disabilities (DD), which means that labour markets, education, and training opportunities should be inclusive and accessible.
PURPOSE: Describe the unmet employment, education and daily needs of adults with DD, with a sub analysis of persons with autism spectrum disorder (ASD) and cerebral palsy (CP) in Canada, to inform efficient and equitable policy development.
METHODS AND PROCEDURES: Secondary analysis of 2012 Canadian Survey on Disability was used to study a sample including working age (15-64 years old) individuals with self-reported DD, CP and ASD. Persons with DD reported on their met and unmet needs in term of activities of daily living, education and employment.
OUTCOMES AND RESULTS: Labour force participation is the lowest for those with DD compared to any other disability. Individuals with CP and ASD report a high level of unmet needs that differ in terms of educational, vocational and daily living supports.

CONCLUSIONS AND IMPLICATIONS: Improving labour force participation to be inclusive and accessible requires policy that considers the range of unmet needs that exist for persons with DD.

Free Article
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PMID: 28412577

Pain and hospital admissions are important factors associated with quality of life in nonambulatory children.
Elema A, Zalmstra TA, Boonstra AM, Narayanan UG, Reinders-Messelink HA, V D Putten AA.
Acta Paediatr. 2016 Sep;105(9):e419-25. doi: 10.1111/apa.13493. Epub 2016 Jun 29.

AIM: This was the first study to investigate the factors associated with health-related quality of life (HRQoL) in nonambulatory children with cerebral palsy (CP), based on a HRQoL measure specifically developed for this population.
METHODS: The Dutch version of the Caregiver Priorities and Child Health Index of Life with Disabilities (CPCHILD-DV) was used to measure HRQoL. It was completed by 66 parents of 47 boys and 19 girls with nonambulatory CP aged between five and 18 years with gross motor function classification system (GMFCS) levels of IV and V. Factors measured were the child's motor and cognitive impairments, comorbidities, pain, parents' education and occupations and family structure. Multiple linear regression analyses were used to determine the significant factors and the relative contribution of these factors to the CPCHILD-DV scores.
RESULTS: The most important factors associated with poorer HRQoL scores were pain and hospital admissions in the previous six months. Other factors were as follows: increased GMFCS level, feeding by gastrostomy tube, inability to communicate verbally, cognitive impairment, poor seizure control and higher parents' educational qualifications.
CONCLUSION: Pain and hospital admissions were the most important factors that were negatively associated with HRQoL in nonambulatory children with CP between five to 18 years.

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PMID: 27250697 [Indexed for MEDLINE]

The relationship of dystonia and choreoathetosis with activity, participation and quality of life in children and youth with dyskinetic cerebral palsy.
Monbaliu E, De Cock P, Mailleux L, Dan B, Feys H.
Eur J Paediatr Neurol. 2017 Mar;21(2):327-335. doi: 10.1016/j.ejpn.2016.09.003. Epub 2016 Sep 23.

AIM: To relate dystonia and choreoathetosis with activity, participation and quality of life (QOL) in children and youth with dyskinetic Cerebral Palsy (CP).
METHODS: Fifty-four participants with dyskinetic CP (mean age 14y6m, SD 4y2m, range 6-22y) were included. The Dyskinesia Impairment Scale (DIS) was used to evaluate dystonia and choreoathetosis. Activity, participation and quality of life (QOL) were assessed with the Gross Motor Function Measure (GMFM), the Functional Mobility Scale (FMS), the Jebsen-Taylor Hand Function Test (JTT), the ABILHAND-Kids Questionnaire (ABIL-K), the Life Habits Kids (LIFE-H) and the Quality of Life Questionnaire for children with CP (CP-QOL). Spearman's rank correlation coefficient (rs) was used to assess the relationship between the movement disorders and activity, participation and QOL measures.
RESULTS: Significant negative correlations were found between dystonia and the activity scales with Spearman's rank correlation coefficient (rs) varying between -0.65 (95% CI = -0.78 to -0.46) and -0.71 (95% CI = -0,82 to -0.55). Correlations were also found with the LIFE-H (rs = -0.43; 95%CI = -0.64 to -0.17) and the CP-QOL (rs = -0.32; 95%CI = -0.56 to -0.03). As far as choreoathetosis is concerned, no or only weak relationships were found with the activity, participation and quality of life scales.
INTERPRETATION: This cross-sectional study is the first to examine the relationship of dystonia and choreoathetosis in dyskinetic CP with the level of activity, participation and QOL. The results revealed dystonia has a higher impact on activity, participation and quality of life than choreoathetosis. These findings seem to suggest it is necessary to first focus on dystonia reducing intervention strategies and secondly on choreoathetosis.

DOI: 10.1016/j.ejpn.2016.09.003

PMID: 27707657 [Indexed for MEDLINE]

Passage à l'âge adulte – Vieillissement

Characteristics of Students Receiving Occupational Therapy Services in Transition and Factors Related to Postsecondary Success.
Am J Occup Ther. 2017 May/Jun;71:7103100010p1-7103100010p8. doi: 10.5014/ajot.2017.024927.
Eismann MM, Weisshaar R, Capretta C, Cleary DS, Kirby AV, Persch AC.

OBJECTIVE: This study had a twofold purpose: (1) identify the characteristics of people with disabilities who received occupational therapy services during their transition to adulthood and (2) determine factors associated with their successful postsecondary transition.
METHOD: This study was a secondary analysis of National Longitudinal Transition Study-2 data. Data analyses include descriptive statistics, binary logistic regression, and simple linear regression.
RESULTS: Autism, cerebral palsy, and intellectual disability were the most commonly reported disability classifications. Participation in postsecondary education was significantly associated with functional use of arms and hands. Postsecondary employment was significantly associated with verbal comprehension. Participation in community activities was significantly related to students' health status, and participation in community service was significantly related to students' functional use of arms and hands.
CONCLUSION: Providing transition services to students with disabilities remains an emerging area of practice. Occupational therapy practitioners may contribute to transition teams by intervening to improve functional abilities and health status.
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PMID: 28422625

Long-term deterioration of perceived health and functioning in adults with cerebral palsy.
Benner JL, Hilberink SR, Veenis T, Stam HJ, van der Slot WMA, Roebroeck ME.
Arch Phys Med Rehabil. 2017 Apr 17. pii: S0003-9993(17)30237-X. doi: 10.1016/j.apmr.2017.03.013. [Epub ahead of print]

OBJECTIVE: To describe longitudinal change in perceived health, presence of health issues and functional level in adults with cerebral palsy (CP). DESIGN: Prospective cohort study.
SETTING: Participants who completed baseline assessments in 1996 or 2000 were invited for a long-term follow-up in 2010.
PARTICIPANTS: Forty-nine Dutch adults with CP (age 35-45 years, 55% male, 75% spastic) formerly known in pediatric rehabilitation care.
INTERVENTIONS: Not applicable.
MAIN OUTCOME MEASURES: Postal questionnaires were completed by the adults or their proxies (n=9). Health outcomes included perceived health (adapted from SF-36), presence of health issues such as pain, severe fatigue (dichotomized), and functional level (Barthel Index; walking performance).
RESULTS: Over a 10-year period, the percentage of adults with CP worrying about their health increased (29 to 54%, p=0.008) and those indicating that health problems limit their activities increased (19 to 45%, p=0.002). In the same period the majority continued to report good general health (93 to 86%, p=0.148). Presence of some health issues increased over time, such as pain; severe fatigue was a common health issue at follow-up (32%). Over a 14-year period, mobility and self-care deteriorated (Barthel Index 17.1 (SD 4.8) to 16.3 (SD 5.6), p=0.007). Walking performance, specifically indoors declined (83 to 71%, p=0.010).
CONCLUSIONS: Adults with CP experienced deterioration in health outcomes in the long-term. Most notably, perceived health and functional level decreased. Pain and severe fatigue were the most common health issues in adult CP. More research is required to explore the mechanisms at work in the process of aging among persons with CP. Systematic follow-up of adults with CP appears necessary to timely detect and intervene on health problems and functional decline.

DOI: 10.1016/j.apmr.2017.03.013 PMID: 28427924

Activité physique -Sport

Evidence for increasing physical activity in children with physical disabilities: a systematic review.
Bloemen M, Van Wely L, Mollema J, Dallmeijer A, de Groot J.
Dev Med Child Neurol. 2017 Apr 4. doi: 10.1111/dmcn.13422. [Epub ahead of print]

AIM: To summarize the best evidence of interventions for increasing physical activity in children with physical disabilities.
METHOD: A systematic review was conducted using an electronic search executed in Academic Search Elite, Academic Search Premier, CINAHL, Embase, MEDLINE, PEDro, PsychINFO, and SPORTDiscus up to February 2016. The selection of articles was performed independently by two researchers according to predetermined eligibility criteria. Data extraction, methodological quality, and levels of evidence were independently assessed by two researchers using a data-collection form from the Cochrane Collaboration and according to the guidelines of the American Academy for Cerebral Palsy and Developmental Medicine.
RESULTS: Seven studies were included. Five randomized controlled trials ranged from strong level I to weak level II studies, and two pre-post design studies were classified as level IV. There is level I evidence for no effect of physical training on objectively measured physical activity, conflicting level II evidence for interventions with a behavioural component on the increase of objectively measured physical activity directly after the intervention, and level II evidence for no effect during follow-up. Results are limited to children with cerebral palsy as no other diagnoses were included.
INTERPRETATION: Increasing physical activity in children with physical disabilities is very complex and demands further development and research.

DOI: 10.1111/dmcn.13422
PMID: 28374442

Longitudinal physical activity and sedentary behaviour in preschool-aged children with cerebral palsy across all functional levels.
Keawutan P, Bell KL, Oftedal S, Ware RS, Stevenson RD, Davies PSW, Boyd RN.
Dev Med Child Neurol. 2017 Apr 22. doi: 10.1111/dmcn.13439. [Epub ahead of print]

AIM: To investigate longitudinal changes of habitual physical activity (HPA) and sedentary time in children with cerebral palsy (CP) aged 1 year 6 months to 5 years across all functional abilities.
METHOD: At study entry, 95 children (62 males, 33 females) were classified using the Gross Motor Function Classification System (GMFCS) at levels I (50), II (9), III (16), IV , and V (14). Physical activity was recorded on a total of 159 occasions at four possible time points: 1 year 6 months to 2 years; 2 years 6 months to 3 years; 4 years; and 5 years using ActiGraph for 3 days. Mixed-effects regression models were used for analyses.
RESULTS: Participants classified at GMFCS levels I and II had stable HPA as they aged. HPA significantly decreased at 5 years in children classified at GMFCS levels III to V. Sedentary time significantly increased at 4 years and 5 years in all participants. Annual HPA significantly reduced in children classified at GMFCS levels III to V (-123 counts/min, 95% confidence interval [CI] -206 to -40) while annual sedentary time significantly increased in all participants (GMFCS levels I-II: 2.4%, 95% CI 0.7-4.1; GMFCS levels III-V: 6.9%, 95% CI 4.6-9.2).
INTERPRETATION: Children with CP at all GMFCS levels should be encouraged to be physically active from early childhood as HPA levels start to decline from 4 years. Breaks in sedentary time are required for all children with CP from the age of 3 years.

DOI: 10.1111/dmcn.13439
PMID: 28432680

Paralympic athletes with cerebral palsy display altered pacing strategies in distance-deceived shuttle running trials.
Runciman P, Tucker R, Ferreira S, Albertus-Kajee Y, DermanW.
Scand J Med Sci Sports. 2016 Oct;26(10):1239-48. doi: 10.1111/sms.12575. Epub2015 Oct 23.

This study investigated performance and physiology to understand pacing strategies in elite Paralympic athletes with cerebral palsy (CP). Six Paralympic athletes with CP and 13 able-bodied (AB) athletes performed two trials of eight sets of 10 shuttles (total 1600m). One trial was distance-deceived (DEC, 1000 m + 600 m) one trial was nondeceived (N-DEC, 1600 m). Time (s), heart rate (HR, bpm), ratings of perceived exertion (RPE, units), and electromyography of five bilateral muscles (EMG) were recorded for each set of both trials. The CP group ran slower than the AB group, and pacing differences were seen in the CP DEC trial, presenting as a flat pacing profile over the trial ($P < 0.05$). HR was higher and RPE was lower in the CP group in both trials ($P < 0.05$). EMG showed small differences between groups, sides, and trials. The present study provides evidence for a possible pacing strategy underlying exercise performance and fatigue in CP. The results of this study show (1) underperformance of the CP group, and (2) altered pacing strategy utilization in the CP group. We proposed that even at high levels of performance, the residual effects of CP may negatively affect performance through selection of conservative pacing strategies during exercise.

DOI: 10.1111/sms.12575
PMID: 26493357 [Indexed for MEDLINE]

Prise en charge et Accompagnant/Accompagnement

Impact of Symptoms of Maternal Anxiety and Depression on Quality of Life of Children with Cerebral Palsy.
Türkoğlu S, Bilgiç A, Türkoğlu G, Yilmaz S.
Noro Psikiyatr Ars. 2016 Mar;53(1):49-54. doi: 10.5152/npa.2015.10132. Epub 2016 Mar 1.

INTRODUCTION: Cerebral palsy (CP) interferes with the quality of life (QOL) of children with CP, and given that parents report having to often guide their children's decision making, it is important to understand the psychosocial factors that have a potential influence on parent-proxy reports. The purpose of this study was to investigate the impact of maternal anxiety and depression symptoms on parent proxy-reported health-related QOL (HRQOL) for children with CP, while controlling other clinical and demographical variables that may have affect HRQOL.
METHODS: The HRQOL scores of 97 outpatients with CP, aged 7-18 years, were assessed using the Pediatric QOL Inventory, Parent version (PedsQL-P). Each patient's type of CP, gross and fine motor function levels, severity of intellectual disability (ID), and other clinical variables were recorded. The levels of depression symptoms in each mother were assessed using the Beck Depression Inventory (BDI), and the levels of anxiety symptoms were assessed with the Beck Anxiety Inventory (BAI).
RESULTS: According to regression analyses, male gender, severity of ID, and higher mothers' BAI scores had negative effects on the PedsQL-P physical scores, and severity of ID and higher mothers' BDI scores had negative effects on the PedsQL-P psychosocial scores. Regarding the determinants of total HRQOL, severity of ID, GMFCS score, and higher mothers' BDI scores negatively impacted the PedsQL-P total scores.
CONCLUSION: Our findings show significant predictor effects of the mothers' anxiety and depressive symptoms, independent from other clinical variables, on the mother-rated HRQOL scores in children with CP.
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PMCID: PMC5353238
PMID: 28360766
Conflict of interest statement: Conflict of Interest: No conflict of interest was declared by the authors.

Technologie - Domotique

Stakeholders' views of the introduction of assistive technology in the classroom: How family-centred is Australian practice for students with cerebral palsy?
Karlsson P, Johnston C, Barker K.
Child Care Health Dev. 2017 Apr 17. doi: 10.1111/cch.12468. [Epub ahead of print]

BACKGROUND: With family-centred care widely recognized as a cornerstone for effective assistive technology service provision, the current study was undertaken to investigate to what extent such approaches were used by schools when assistive technology assessments and implementation occurred in the classroom.
METHOD: In this cross-sectional study, we compare survey results from parents (n = 76), school staff (n = 33) and allied health professionals (n = 65) with experience in the use of high-tech assistive technology. Demographic characteristics and the stakeholders' perceived helpfulness and frequency attending assessment and set-up sessions were captured. To evaluate how family-centred the assistive technology services were perceived to be, the parents

filled out the Measure of Processes of Care for Caregivers, and the professionals completed the Measure of Processes of Care for Service Providers. Descriptive statistics and one-way analysis of variance were used to conduct the data analysis.
RESULTS: Findings show that parents are more involved during the assessment stage than during the implementation and that classroom teachers are often not involved in the initial stage. Speech pathologists in particular are seen to be to a great extent helpful when implementing assistive technology in the classroom. This study found that family-centred service is not yet fully achieved in schools despite being endorsed in early intervention and disability services for over 20 years. No statistically significant differences were found with respect to school staff and allied health professionals' roles, their years of experience working with students with cerebral palsy and the scales in the Measure of Processes of Care for Service Providers.
CONCLUSION: To enhance the way technology is matched to the student and successfully implemented, classroom teachers need to be fully involved in the whole assistive technology process. The findings also point to the significance of parents' involvement, with the support of allied health professionals, in the process of selecting and implementing assistive technology in the classroom.

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PMID: 28419501

Wheelchair appropriateness in children with cerebral palsy: A single center experience.
Ekiz T, Demir SÖ, Sümer HG, Özgirgin N.
J Back Musculoskelet Rehabil. 2017 Mar 31. doi: 10.3233/BMR-150522. [Epub ahead of print]

BACKGROUND: Although wheelchair appropriateness has been studied in general wheelchair users and spinal cord injury patients, it has not been studied in children with cerebral palsy yet.
OBJECTIVE: To describe the wheelchair appropriateness in children with cerebral palsy.
MATERIALS AND METHODS: Thirty children with cerebral palsy were included. Demographical and clinical features of the children were noted. All wheelchair parts were evaluated by the same rehabilitation physician who has attended a wheelchair-training course. Overall, the wheelchair was accepted as inappropriate if at least three parts were inappropriate.
RESULTS: There were 30 children (15 M, 15 F) with a mean age of 10.8 ± 3.5 years. Seat depth (n= 21, 70%), cushion (n= 17, 56.7%), seat height (n= 16, 53.3%), and footrest (n= 16, 53.3%) were the most common inappropriate parts. Overall, 24 (80%) of the children use inappropriate wheelchair. Two (6.7%) children obtained wheelchairs by prescription, 28 (93.3%) obtained without prescription. Twenty-nine wheelchairs were manual and one wheelchair was motorized. Among 30 children, five (16.7%) experienced at least one wheelchair-related fall.
CONCLUSION: In the light of our results, 80% of the children with cerebral palsy seem to use inappropriate wheelchair. Individually designed wheelchairs should be maintained for these children.
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