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Interventions and Management

1. Clin Rehabil. 2016 Jun 29. pii: 0269215516656468. [Epub ahead of print]

Effectiveness of backward walking training on walking ability in children with hemiparetic cerebral palsy: A randomized controlled trial.

Abdel-Aziem AA, El-Basatiny HM.

OBJECTIVE: To compare the effects of backward walking training and forward walking training on spatiotemporal gait parameters, and gross motor function measures in children with cerebral palsy. **DESIGN:** Randomized controlled clinical trial. **SETTING:** Physical therapy clinics. **SUBJECTS:** A total of 30 children with hemiparetic cerebral palsy of both sexes (10 to 14 years of age, classified as I or II by gross motor function classification system) participated in this study. They were randomly assigned into two equal groups. **INTERVENTIONS:** Both groups received a conventional physical therapy program for 12 successive weeks (three sessions per week). The experimental group additionally received (25 min) backward walking training. The control group additionally received (25 min) forward walking training. **OUTCOME MEASURES:** Baseline, posttreatment, and follow-up assessment for spatiotemporal gait parameters and gross motor functions were evaluated by using three dimensional gait analysis system and gross motor function measures. **RESULTS:** There was a significant improvement in step length, walking velocity, cadence, stance phase, and swing phase percentage and gross motor function measures (Dimensions D and E) of the experimental group (0.55 ± 0.16 , 0.53 ± 0.19 , 121.73 ± 2.89 , 54.73 ± 1.67 , 44.40 ± 1.40 , 90.20 ± 6.44 , 82.47 ± 12.82), respectively, than the control group (0.39 ± 0.13 , 0.46 ± 0.20 , 125.80 ± 2.96 , 50.27 ± 1.62 , 49.47 ± 1.55 , 82.47 ± 7.05 , 80.47 ± 12.61), respectively, ($p < 0.05$). The significant improvement of all measured outcomes of the experimental group was maintained at 1 month follow-up assessment ($p < 0.05$). **CONCLUSION:** In addition to a conventional physical therapy program, backward walking training is more effective than forward walking training on spatiotemporal gait parameters, and gross motor function measures in children with hemiparetic cerebral palsy.

[PMID: 27356944](#)

2. J Child Orthop. 2016 Jun 27. [Epub ahead of print]

A balanced approach for stable hips in children with cerebral palsy: a combination of moderate VDRO and pelvic osteotomy.

Reidy K, Heidt C, Dierauer S, Huber H.

BACKGROUND: Hip reconstructive surgery in cerebral palsy (CP) patients necessitates either femoral varus derotational osteotomy (VDRO) or pelvic osteotomy, or both. The purpose of this study is to review the results of a moderate varisation [planned neck shaft angle (NSA) of 130°] in combination with pelvic osteotomy for a consecutive series of patients. **METHODS:** Patients with CP who had been treated at our institution for hip dysplasia, subluxation or dislocation with VDRO in combination with pelvic osteotomy between 2005 and 2010 were reviewed. **RESULTS:** Forty patients with a mean follow-

up of 5.4 years were included. The mean age at the time of operation was 8.9 years. The majority were non-ambulant children [GMFCS I-III: n = 11 (27.5 %); GMFCS IV-V: n = 29 (72.5 %)]. In total, 57 hips were treated with both femoral and pelvic osteotomy. The mean pre-operative NSA angle of 152.3° was reduced to 132.6° post-operatively. Additional adductor tenotomy was performed in nine hips (16 %) at initial operation. Reimers' migration percentage (MP) was improved from 63.6 % pre-operatively to 2.7 % post-operatively and showed a mean of 9.7 % at the final review. The results were good in 96.5 % (n = 55) with centred, stable hips (MP <33 %), fair in one with a subluxated hip (MP 42 %) and poor in one requiring revision pelvic osteotomy for ventral instability. CONCLUSIONS: This approach maintains good hip abduction and reduces soft-tissue surgery. Moderate varisation in VDRO in combination with pelvic osteotomy leads to good mid-term results with stable, pain-free hips, even in patients with severe spastic quadriplegia.

[PMID: 27349432](#)

3. Dev Med Child Neurol. 2016 Jun 25. doi: 10.1111/dmcn.13190. [Epub ahead of print]

Proactive treatment of hip subluxation in cerebral palsy.

Bauer J.

[No abstract available]

[PMID: 27343146](#)

4. J Korean Med Sci. 2016 Jul;31(7):1143-9. doi: 10.3346/jkms.2016.31.7.1143. Epub 2016 May 19.

Progression of Hip Displacement during Radiographic Surveillance in Patients with Cerebral Palsy.

Park JY, Choi Y, Cho BC, Moon SY, Chung CY, Lee KM, Sung KH, Kwon SS, Park MS.

Progression of hip displacement is common in patients with cerebral palsy (CP). We aimed to investigate the rate of progression of hip displacement in patients with CP by assessing changes in radiographic indices according to Gross Motor Function Classification System (GMFCS) level during hip surveillance. We analyzed the medical records of patients with CP aged < 20 years who underwent at least 6 months interval of serial hip radiographs before any surgical hip intervention, including reconstructive surgery. After panel consensus and reliability testing, radiographic measurements of migration percentage (MP), neck-shaft angle (NSA), acetabular index (AI), and pelvic obliquity (PO) were obtained during hip surveillance. For each GMFCS level, annual changes in radiographic indices were analyzed and adjusted for affecting factors, such as sex, laterality, and type of CP. A total of 197 patients were included in this study, and 1,097 radiographs were evaluated. GMFCS classifications were as follows: 100 patients were level I-III, 48 were level IV, and 49 were level V. MP increased significantly over the duration of hip surveillance in patients with GMFCS levels I-III, IV, and V by 0.3%/year (P < 0.001), 1.9%/year (P < 0.001), and 6.2%/year (P < 0.001), respectively. In patients with GMFCS level IV, NSA increased significantly by 3.4%/year (P < 0.001). Our results suggest that periodic monitoring and radiographic hip surveillance is warranted for patients with CP, especially those with GMFCS level IV or V. Furthermore, physicians can predict and inform parents or caregivers regarding the progression of hip displacement in patients with CP.

[PMID: 27366015](#)

5. Gait Posture. 2016 Jun 6;48:249-255. doi: 10.1016/j.gaitpost.2016.06.004. [Epub ahead of print]

"Children with cerebral palsy experience greater levels of loading at the low back during gait compared to healthy controls".

Kiernan D, Malone A, O'Brien T, Simms CK.

Excessive trunk motion has been shown to be characteristic of cerebral palsy (CP) gait. However, the associated demands on the lower spine are unknown. This study investigated 3-dimensional reactive forces and moments at the low back in CP children compared to healthy controls. In addition, the impact of functional level of impairment was investigated (GMFCS levels). Fifty-two children with CP (26 GMFCS I and 26 GMFCS II) and 26 controls were recruited to the study. Three-

dimensional thorax kinematics and reactive forces and moments at the low back (L5/S1 spine) were examined. Discrete kinematic and kinetic parameters were assessed between groups. Thorax movement demonstrated increased range for CP children in all 3 planes while L5/S1 reactive forces and moments increased with increasing level of functional impairment. Peak reactive force data were increased by up to 57% for GMFCS I and 63% for GMFCS II children compared to controls. Peak moment data were increased by up to 21% for GMFCS II children compared to GMFCS I and up to 90% for GMFCS II compared to control. In addition, a strong correlation was demonstrated between thorax side flexion and L5/S1 lateral bend moment ($r=0.519$, $p<0.01$) and medial/lateral force ($r=0.352$, $p<0.01$). Children with CP demonstrated increased lower spinal loading compared to TD. Furthermore, GMFCS II children demonstrated significantly more involvement. Intervention should be aimed at reducing excessive thorax movement, especially in the coronal plane, in order to reduce abnormal loading on the spine in this population.

[PMID: 27343832](#)

6. J Appl Biomech. 2016 Jun 24. [Epub ahead of print]

Changes in Mobility and Muscle Function of Children With Cerebral Palsy After Gait Training: A Pilot Study.

Hegarty AK, Kurz MJ, Stuber W, Silverman AK.

The goal of this pilot study was to characterize the effects of gait training on the capacity of muscles to produce body accelerations, and relate these changes to mobility improvements seen in children with cerebral palsy (CP). Five children (14 years \pm 3 years; GMFCS I-II) with spastic diplegic CP participated in a six-week gait training program. Changes in the fast-as-possible walking speed and 6-minute walking endurance were used to assess changes in activity levels. In addition, musculoskeletal modeling was used to determine the potential of lower-limb muscular function to accelerate the body's center of mass vertically and forward during stance. The mobility changes after the training were mixed with some children demonstrating vast improvements, while others appeared to be minimal. However, the musculoskeletal results revealed unique responses for each child. The most common changes occurred in the capacity for the hip and knee extensors to produce body support and the hip flexors to produce body propulsion. These results cannot yet be generalized to the broad population of children with CP, but demonstrate that therapy protocols may be enhanced by modeling analyses. The pilot study results provide motivation for gait training emphasizing upright leg posture, mediolateral balance and ankle push-off.

[PMID: 27348240](#)

7. Gait Posture. 2016 Jun 15;49:14-18. doi: 10.1016/j.gaitpost.2016.06.017. [Epub ahead of print]

Reliability and validity of Edinburgh visual gait score as an evaluation tool for children with cerebral palsy.

Del Pilar Duque Orozco M, Abousamra O, Church C, Lennon N, Henley J, Rogers KJ, Sees JP, Connor J, Miller F.

Assessment of gait abnormalities in cerebral palsy (CP) is challenging, and access to instrumented gait analysis is not always feasible. Therefore, many observational gait analysis scales have been devised. This study aimed to evaluate the interobserver reliability, intraobserver reliability, and validity of Edinburgh visual gait score (EVGS). Video of 30 children with spastic CP were reviewed by 7 raters (10 children each in GMFCS levels I, II, and III, age 6-12 years). Three observers had high level of experience in gait analysis (10+ years), two had medium level (2-5 years) and two had no previous experience (orthopedic fellows). Interobserver reliability was evaluated using percentage of complete agreement and kappa values. Criterion validity was evaluated by comparing EVGS scores with 3DGA data taken from the same video visit. Interobserver agreement was 60-90% and Kappa values were 0.18-0.85 for the 17 items in EVGS. Reliability was higher for distal segments (foot/ankle/knee 63-90%; trunk/pelvis/hip 60-76%), with greater experience (high 66-91%, medium 62-90%, no-experience 41-87%), with more EVGS practice (1st 10 videos 52-88%, last 10 videos 64-97%) and when used with higher functioning children (GMFCS I 65-96%, II 58-90%, III 35-65%). Intraobserver agreement was 64-92%. Agreement between EVGS and 3DGA was 52-73%. We believe that having EVGS as part of the standardized gait evaluation is helpful in optimizing the visual scoring. EVGS can be a supportive tool that adds quantitative data instead of only qualitative assessment to a video only gait evaluation.

[PMID: 27344448](#)

8. Med Sci Sports Exerc. 2016 May;48(5 Suppl 1):344. doi: 10.1249/01.mss.0000486044.71096.2b.

The Relationship Between Lower Extremity Functional Strength and Aerobic Performance in Youth with Cerebral Palsy: 1319
June 2, 9: 00 AM - 9: 15 AM.

Mendonca CJ, Smith SA, O'Neil ME.

[No abstract available]

[PMID: 27360238](#)

9. Dev Med Child Neurol. 2016 Jul 1. doi: 10.1111/dmcn.13194. [Epub ahead of print]

Motorized versus manual instrumented spasticity assessment in children with cerebral palsy.

Sloot LH, Bar-On L, van der Krogt MM, Aertbeliën E, Buizer AI, Desloovere K, Harlaar J.

AIM: We compared the outcomes of manual and motorized instrumented ankle spasticity assessments in children with cerebral palsy (CP). METHOD: Ten children with spastic CP (three males, seven females; mean age 11 y [standard deviation 3y], range 6-14y; Gross Motor Function Classification System levels I-III) were included. During motorized assessments, fast (100°/s) rotations were imposed around the ankle joint by a motor-driven footplate; during manual assessments, rotations of comparable speed were applied by a therapist using a foot orthotic. Angular range of motion, maximum velocity, acceleration, work, and muscle activity (electromyography [EMG]) of the triceps surae and tibialis anterior were compared during passive muscle stretch between motorized and manual assessments. Both movement profiles were also compared to CP gait ankle movement profile. RESULTS: The imposed movement profile differed between methods, with the motorized assessment reaching higher maximum acceleration. Despite equal maximum velocity, the triceps surae were more often activated in motorized assessments, with low agreement of 44% to 72% ($\kappa \leq 0$) for EMG onset occurrence between methods. The manually applied ankle velocity profile matched more closely with the gait profile. INTERPRETATION: The differences in acceleration possibly account for the different muscle responses, which may suggest acceleration, rather than velocity-dependency of the stretch reflex. Future prototypes of instrumented spasticity assessments should standardize movement profiles, preferably by developing profiles that mimic functional tasks such as walking.

[PMID: 27363603](#)

10. Dev Med Child Neurol. 2016 Jun 27. doi: 10.1111/dmcn.13180. [Epub ahead of print]

Risk of stroke among patients with cerebral palsy: a population-based cohort study.

Wu CW, Huang SW, Lin JW, Liou TH, Chou LC, Lin HW.

AIM: The aim of the study was to investigate the risk of stroke in patients with cerebral palsy (CP), based on nationwide data in Taiwan. METHOD: This prospective cohort study was comprised of patients recorded on the Taiwan Longitudinal Health Insurance Database 2005 (LHID2005) who had a diagnosis of CP (n=1975) in records between 1 January 2004 and 31 December 2007. A comparison group (1:5) drawn from the same database was matched for age and sex (n=9875). Each patient was tracked by data until the development of stroke or the end of 2008. Cox proportional-hazards regression analysis was used to evaluate the hazard ratios after adjusting for potential confounding factors. RESULTS: Patients with CP were more likely to suffer stroke than the comparison population, after adjusting for potential confounding factors (adjusted hazard ratio: 2.17; 95% confidence interval [CI]: 1.74-2.69). The hazard ratio of stroke was 4.78 (95% CI: 3.18-7.17) and 1.57 (95% CI: 1.20-2.05) for patients with CP aged 50 years and under, and over 50 years respectively. INTERPRETATION: Cerebral palsy is a risk factor or marker for stroke that is independent of traditional stroke risk factors. Further research in this area is warranted.

[PMID: 27346658](#)

11. Med Sci Sports Exerc. 2016 May;48(5 Suppl 1):1004. doi: 10.1249/01.mss.0000488020.58602.9f.

Bone Mineral Density Of Affected And Non Affected Sides In Paralympic Athletes With Cerebral Palsy: 3617 Board #56 June 4, 9: 30 AM - 11: 00 AM.

Runciman P, Tucker R, Ferreira S, Albertus-Kajee Y, Derman W.

[No abstract available]

[PMID: 27361983](#)

12. J Child Neurol. 2016 Jun 30. pii: 0883073816656402. [Epub ahead of print]

The Influence of Neurodevelopmental Treatment on Transforming Growth Factor- β 1 Levels and Neurological Remodeling in Children With Cerebral Palsy.

Tao W, Lu Z, Wen F.

Neurodevelopmental treatment is an advanced therapeutic approach for the neural rehabilitation of children with cerebral palsy. Cerebral palsy represents a spectrum of neurological disorders primarily affecting gross motor function. The authors investigated the effects of neurodevelopmental treatment on serum levels of transforming growth factor- β 1 (TGF- β 1), a neuroprotective cytokine, and improvements to motor skills. Serum TGF- β 1 levels and total score of the Gross Motor Function Measure-88 (GMFM-88) were significantly higher in children with cerebral palsy who underwent neurodevelopmental treatment compared to untreated patients ($P < .01$). Furthermore, the improved GMFM-88 total scores after neurodevelopmental treatment were significantly higher in children under the age of 3 with cerebral palsy than in older patients ($P < .01$). The authors demonstrate that the integration of TGF- β 1 levels and GMFM-88 total score could be used to assess the efficacy of neurodevelopmental treatment. Moreover, the findings provide further scientific support for the early intervention and neurological rehabilitation of young children with cerebral palsy.

[PMID: 27364738](#)

13. Pain Manag Nurs. 2016 Jun 24. pii: S1524-9042(16)00084-9. doi: 10.1016/j.pmn.2016.03.002. [Epub ahead of print]

Professionals' Perceptions about the Need for Pain Management Interventions for Children with Cerebral Palsy in South African School Settings.

Nilsson S, Johnson E, Adolfsson M.

Pain is common in children with cerebral palsy (CP) and may have negative consequences for children's success in their studies. Research has shown that pain in childhood negatively influences individuals' participation and quality of life in later years. This study investigated how professionals in South African school settings respond to children's need for pain management in an attempt to enable the children to be active participants in school activities, despite their pain. The study was descriptive and followed a qualitative design (i.e., focus group interviews with semistructured questions and a conventional content analysis). Five government schools for children with special education needs in South Africa's Gauteng province participated. Participants/Subjects: Thirty-eight professionals who represented eight professions. Professional statements on the topic were collected from five focus group sessions conducted during one week. Qualitative content analysis of the data was performed. Similar statements were combined, coded, and sorted into main categories and subcategories. The analysis identified three main categories for pain management: environmental, treatment, and support strategies. In addition, four groups of statements emerged on how contextual factors might affect pain in children with CP and their participation in school settings. It is important to train professionals in pain management and to implement structured models for pain prevention and management to ensure that best practices are adhered to for children with CP who suffer from acute or chronic pain.

[PMID: 27349380](#)

14. J Neurosci Rural Pract. 2016 Jul-Sep;7(3):355-61. doi: 10.4103/0976-3147.182778.

Quality of life of cerebral palsy patients and their caregivers: A cross sectional study in a rehabilitation center Khartoum-Sudan (2014 - 2015).

Mohammed FM, Ali SM, Mustafa MA.

BACKGROUND: Cerebral palsy (CP) is group of disorders characterized by long-term disabilities that affect the quality of life (QoL) of both patients and those caring for them. **OBJECTIVE:** The objective of this study was to measure the QoL of CP patients and their caregivers and determine the factors affecting both of them. **METHODS:** This was a cross-sectional facility-based study. 65 caregivers of children with CP aged 4-18 years completed a self-structured questionnaire. Descriptives of the samples were displayed, and logistic regression was used in the analysis. **RESULTS:** The scores of overall QoL of both children and caregivers were low, however, variations were observed among different domains. Both health-related and sociodemographic factors were found to affect the QoL of children and caregivers. The increase in the degree of disability and presence of complications decreased the children QoL while the availability of health insurance improved it. Whereas the QoL of the caregiver was affected by his/her occupation, the degree of child disability did not affect it. **CONCLUSIONS:** This study showed that many feasible changes can be adopted to improve the QoL of CP patients and their caregivers.

[PMID: 27365951](#)

15. Phys Occup Ther Pediatr. 2016 Jul 1:1-16. [Epub ahead of print]

Parents' Experiences and Perceptions when Classifying their Children with Cerebral Palsy: Recommendations for Service Providers.

Scime NV, Bartlett DJ, Brunton LK, Palisano RJ.

AIMS: This study investigated the experiences and perceptions of parents of children with cerebral palsy (CP) when classifying their children using the Gross Motor Function Classification System (GMFCS), the Manual Ability Classification System (MACS), and the Communication Function Classification System (CFCS). The second aim was to collate parents' recommendations for service providers on how to interact and communicate with families. **METHODS:** A purposive sample of seven parents participating in the On Track study was recruited. Semi-structured interviews were conducted orally and were audiotaped, transcribed, and coded openly. A descriptive interpretive approach within a pragmatic perspective was used during analysis. **RESULTS:** Seven themes encompassing parents' experiences and perspectives reflect a process of increased understanding when classifying their children, with perceptions of utility evident throughout this process. Six recommendations for service providers emerged, including making the child a priority and being a dependable resource. **CONCLUSIONS:** Knowledge of parents' experiences when using the GMFCS, MACS, and CFCS can provide useful insight for service providers collaborating with parents to classify function in children with CP. Using the recommendations from these parents can facilitate family-provider collaboration for goal setting and intervention planning.

[PMID: 27366828](#)

Prevention and Cure

16. *Am J Perinatol.* 2016 Jul 1. [Epub ahead of print]

Birthweight Extremes and Neonatal and Childhood Outcomes after Preterm Premature Rupture of Membranes.

Grace MR, Dotters-Katz S, Varner MW, Boggess K, Manuck TA.

Objective To determine the association between birthweight extremes and risk of adverse neonatal and childhood outcomes following preterm premature rupture of membranes (PPROM). **Study Design** This is a secondary analysis of data from the Beneficial Effects of Antenatal Magnesium Sulfate Trial. Women with nonanomalous singletons and PPRM delivering ≥ 24.0 weeks were included. Birthweight was classified as small for gestational age (SGA), appropriate for gestational age (AGA), or large for gestational age (LGA). Composite severe neonatal morbidity and childhood outcomes at age 2, were compared between these groups. **Results** One thousand five hundred and ninety-eight infants were included (58 SGA, 1,354 AGA, and 186 LGA). There was an inverse relationship between birthweight and rate of composite major neonatal morbidity (55.2% of SGA, 31.5% of AGA, 18.3% of LGA, $p < 0.001$). Former-SGA children were more likely to be diagnosed with major composite childhood morbidity at age 2 (25.9% of SGA, 8.3% of AGA, 5.9% of LGA, $p < 0.001$). In multivariate models, LGA infants had improved initial neonatal outcomes compared with AGA infants (adjusted odds ratio [aOR], 0.44; 95% confidence interval [CI], 0.28-0.71; $p = 0.001$). **Conclusions** Among infants delivered following PPRM, those who were LGA at delivery had improved composite adverse neonatal outcomes. SGA increases the risk of severe neonatal morbidity, early childhood death, and moderate/severe cerebral palsy at age 2.

[PMID: 27367280](#)

17. *J Obstet Gynaecol Res.* 2016 Jun 29. doi: 10.1111/jog.13074. [Epub ahead of print]

Significance of oligohydramnios in preterm small-for-gestational-age infants for outcome at 18 months of age.

Sasahara J, Ishii K, Umehara N, Oba M, Kiyoshi K, Murakoshi T, Tanemoto T, Ishikawa H, Ichizuka K, Yoshida A, Tanaka K, Ozawa K, Sago H.

AIM: The aim of this study was to evaluate the association between oligohydramnios and other perinatal factors in preterm small-for-gestational-age (SGA) infants who had cerebral palsy at 18 months of age or who had died before this age. **METHODS:** This retrospective study included 320 infants with birthweights < 3 rd percentile delivered between 22 and 33 complete weeks of gestation. We evaluated the incidence of CP at 18 months of age and of death before this age. The significant risk factors, including oligohydramnios, of CP or death of preterm SGA infants were evaluated by logistic regression analysis. **RESULTS:** The incidence of CP or death was 47/320 (14.7%), consisting of 24/320 (7.5%) cases of CP and 23/320 (7.2%) cases of death. Oligohydramnios (adjusted odds ratio, 2.18; 95% confidence interval, 1.07-4.45) and gestational age (adjusted odds ratio, 0.76; 95% confidence interval, 0.66-0.87) were independently correlated with outcome. **CONCLUSION:** The incidence of adverse outcomes was approximately 15% in preterm SGA infants. SGA infants born with oligohydramnios may be at increased risk for CP or death compared to those with normal amniotic volume.

[PMID: 27352940](#)