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Interventions and Management

1. Gait Posture. 2012 Nov 27. pii: S0966-6362(12)00392-X. doi: 10.1016/j.gaitpost.2012.10.019. [Epub ahead of print]

Muscle contributions to vertical and fore-aft accelerations are altered in subjects with crouch gait.

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The goals of this study were to determine if the muscle contributions to vertical and fore-aft acceleration of the mass center differ between crouch gait and unimpaired gait and if these muscle contributions change with crouch severity. Examining muscle contributions to mass center acceleration provides insight into the roles of individual muscles during gait and can provide guidance for treatment planning. We calculated vertical and fore-aft accelerations using musculoskeletal simulations of typically developing children and children with cerebral palsy and crouch gait. Analysis of these simulations revealed that during unimpaired gait the quadriceps produce large upward and backward accelerations during early stance, whereas the ankle plantarflexors produce large upward and forward accelerations later in stance. In contrast, during crouch gait, the quadriceps and ankle plantarflexors produce large, opposing fore-aft accelerations throughout stance. The quadriceps force required to accelerate the mass center upward was significantly larger in crouch gait than in unimpaired gait and increased with crouch severity. The gluteus medius accelerated the mass center upward during midstance in unimpaired gait; however, during crouch gait the upward acceleration produced by the gluteus medius was significantly reduced. During unimpaired gait the quadriceps and ankle plantarflexors accelerate the mass center at different times, efficiently modulating fore-aft accelerations. However, during crouch gait, the quadriceps and ankle plantarflexors produce fore-aft accelerations at the same time and the opposing fore-aft accelerations generated by these muscles contribute to the inefficiency of crouch gait.

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2. Ortop Traumatol Rehabil. 2012 Aug 31;14(5):453-65. doi: 10.5604/15093492.1005088.**Foot and knee behaviour during gait in response to the use of additional means of treatment in cerebral palsied children.**

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Background. Physiological human gait is characterized by changes of foot and knee angle that make the gait efficient and not require excessive energy expenditure. In cerebral palsied children, the foot-knee relationship is disturbed by pathological synergies. Therefore, ways to improve this situation are sought. The aim of the study was to verify whether and how well the use of botulinum toxin or inhibitive casts alters the behaviour of the foot-knee complex in cerebral palsy gait. **Material and methods.** The study involved 34 hemiparetic children with cerebral palsy aged 7-14 years who were able to walk unassisted. Neurodevelopmental treatment according to the NDT-Bobath method was given to all the children. Two groups were formed. In the first group of 16 children, inhibitive castings were used. The second group of 18 children received Btx-A injections. Gait analysis was performed at baseline and one month after administering these additional treatments. The CMS-HS ultrasonic system (Zebris) was used for three dimensional gait analysis. **Results.** Apart from the pattern asymmetry characteristic of a hemiplegic gait, various pronounced abnormalities of the foot-knee complex were observed. Following treatment, gait symmetry improved in both groups as did the position of the hemiparetic foot in the mid-support phase. In the inhibitive casting groups, similar improvements were also observed in the initial contact phase. In the knee, greater improvement in knee was noted in the Btx-A group. **Conclusions.** Btx-A injections or inhibitive casts improve gait parameters in cerebral palsied children. This improvement is individual and seen in different stages of the support phase, but of similar magnitude following the use of either treatment. Achieving simultaneous improvement in the knee and foot is difficult.

[PMID: 23208937](#) [PubMed - in process]**3. Vopr Kurortol Fizioter Lech Fiz Kult. 2012 Sep-Oct;(5):33-6.****The role of microcurrent reflexotherapy in combination with neuroprotector in the rehabilitation of the patients with infantile cerebral palsy [Article in Russian]**

[No authors listed]

The objective of the present study was to estimate the therapeutic efficacy of the combined treatment of infantile cerebral palsy by means of microcurrent reflexotherapy (MCRT) in combination with the neuroprotector cortexin. This treatment including 15 sessions with the use of a MAKES apparatus was given to 69 children at the age from 3 to 7 years. They were randomly allocated to two groups. The patients of group 1 underwent three courses of MCRT and two courses of cortexin therapy in conjunction with massage and remedial gymnastics, those in group 2 were treated with massage and remedial gymnastics alone. Positive dynamics in the patients' clinical conditions was documented in the end of the rehabilitative program. Specifically, 60.5% of the children in group 1 developed the ability to walk unassisted compared with 38.6% in group 2. Positive changes in the brain functional status were documented, based on the results of the electroencephalographic study, in 21 (71%) and 16 (53%) children of groups 1 and 2 respectively.

[PMID: 23210360](#) [PubMed - in process]**4. Eur J Paediatr Neurol. 2012 Nov 29. pii: S1090-3798(12)00232-2. doi: 10.1016/j.ejpn.2012.11.002. [Epub ahead of print]****Involuntary and voluntary muscle activation in children with unilateral cerebral palsy - Relationship to upper limb activity.**

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BACKGROUND: Spasticity and reduced strength are both primary neuromuscular impairments associated with cerebral palsy (CP). However, it is unclear whether spasticity or reduced strength is the strongest contributor to activity limitations. **AIM:** To study whether involuntary activation of the biceps brachii muscle, in addition to reduced strength, contributes to limitations in upper limb activity in children with CP. **METHOD:** Fifteen children with unilateral CP (9 males and 6 females, age range 8-17 years) participated in this study. Involuntary activation, reflecting spasticity, was studied as biceps brachii activity during passive elbow extension at four isokinetic velocities (10, 90, 180 and 300°/s). Elbow flexion peak torque, reflecting strength, was measured during maximal voluntary isometric contraction, and concurrent biceps brachii activity was registered reflecting voluntary muscle activation. Bimanual upper limb activity was assessed in the performance domain using the Assisting Hand Assessment (AHA). **RESULTS:** Both involuntary and voluntary muscle activation were related to activity, the former negatively, but voluntary activation showed the strongest relationship (Spearman's rho = .84). Involuntary muscle activation at 10, 90 and 180°/s was negatively related to muscle strength (Spearman's rho = -.63, -.58 and -.62, respectively). **CONCLUSIONS:** Our results do not indicate that spasticity affects upper limb activity in addition to strength. Most likely, muscle weakness and spasticity jointly contribute to activity limitations, reflected by the strong relationship between the ability to voluntarily activate a muscle and activity performance.

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5. Ann Nutr Metab. 2012;61(4):349-57. doi: 10.1159/000342557. Epub 2012 Dec 3.

Relationships between Dietary Intake and Body Composition according to Gross Motor Functional Ability in Preschool-Aged Children with Cerebral Palsy.

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Background/Aims: We aimed to determine the relationships between energy intake, macronutrient intake and body composition in preschool-aged children with cerebral palsy (CP) according to gross motor functional ability in comparison with typically developing children (TDC). **Methods:** Seventy-three children with CP (70% male) of all functional abilities and 16 TDC (63% male) aged 2.8 ± 0.9 years participated in this study. Dietary intake was measured via a validated 3-day weighed food record. Body composition was determined via isotope dilution techniques. **Results:** There was a significant relationship between energy intake and fat-free mass index, which was stronger in TDC compared to children with CP. There were no significant correlations between other dietary intake and body composition variables, despite differences in body composition as ambulatory status declined. Non-ambulant, tube-fed children had significantly lower protein intakes compared to orally fed children. No other differences in macronutrient intake between children with CP and TDC were apparent. **Conclusions:** Results suggest that relationships between dietary intake and body composition are not evident in this population, but develop over time. Physical activity levels may have a greater impact on body composition at this age. Longitudinal research is required to examine these factors.

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6. Child Care Health Dev. 2012 Nov 30. doi: 10.1111/cch.12018. [Epub ahead of print]

Respect for autonomy in the healthcare context: observations from a qualitative study of young adults with cerebral palsy.

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BACKGROUND: Respect for patient autonomy is a cornerstone of contemporary medical ethics and clinical practice. In its different shapes and forms (e.g. being informed, being engaged in discussions and decisions about medical care and being supported in developing healthcare preferences and choices), patient autonomy has been fostered by both paediatric and adult professional societies. The transition from paediatric to adult care creates a complex situation where autonomy for medical decisions shifts to the developing adolescent. More specific challenges to respect for autonomy may be experienced by young adults with cerebral palsy in the transition period where, for example, language and motor impairments may affect communication skills and this may be conflated with cognitive disability. **AIM:** To characterize perspectives towards autonomy in the healthcare context for young adults with cerebral palsy. **METHOD:** We carried out semi-structured interviews with 14 young adults (aged 18-25) with cerebral palsy. The audiotaped interviews were transcribed verbatim and analysed using a conventional thematic qualitative content analysis. **RESULTS:** Participants displayed a range of attitudes towards autonomy, suggesting that the value of autonomy is considered in light of competing values and of context. Testimonials from participants demonstrated that both contextual (e.g. ill-adapted health care, lack of specialized public transport) and relational (e.g. attitudes towards parental involvement in decision making) factors negatively or positively impact autonomy. **CONCLUSION:** We observed that there were four key elements interwoven in participants' characterization of autonomy: the coupling of decisional and physical autonomy, the influences of family and society on autonomy, the influence of healthcare professionals on autonomy and the need for preparation for autonomy.

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7. Child Care Health Dev. 2012 Dec 5. doi: 10.1111/cch.12012. [Epub ahead of print]

Cross-cultural validation of the Children's Assessment of Participation and Enjoyment (CAPE) in Spain.

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BACKGROUND: Despite growing interest in the topic of participation, the construct has not yet been assessed in children and adolescents with and without cerebral palsy (CP) in Spain. As there are no available instruments to measure participation in leisure activities which have been adapted in this country, the goal of this study was to validate a Spanish version of the Children's Assessment of Participation and Enjoyment (CAPE). **METHOD:** The sample comprised 199 children and adolescents with CP and 199 without CP, between 8 and 18 years of age, from seven regions in Spain. The adaptation of the original version of CAPE was carried out through translation and backward translation, and the validity of the instrument was analysed. Construct validity was assessed through the correlation of the diverse CAPE domains and the quality of life domains (KIDSCREEN questionnaire). Discriminant validity was established by comparing children and adolescents with CP and typically developing children and adolescents. For test-retest reliability, the children and adolescents with and without CP completed the CAPE questionnaire twice within 4 weeks. **RESULTS:** The correlations found between the CAPE domains and the quality of life domains show that the CAPE presents construct validity. The CAPE discriminated children and adolescents with CP from those without any disability in the results of participation. According to most CAPE domains, typically developing children and adolescents engage in a greater number of activities than children and adolescents with CP. Test-retest reliability for the Spanish version of CAPE was adequate. **CONCLUSION:** The study provides a valid instrument to assess the participation of children and adolescents with and without CP who live in Spain.

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8. Disabil Rehabil. 2012 Dec 3. [Epub ahead of print]**Factor analysis of the WeeFIM in children with spastic cerebral palsy.**

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Purpose: Determining the psychometric properties such as reliability and validity of Functional Independence Measure for Children (WeeFIM) instrument would help health professionals to understand the comprehensive assessment of children with spastic cerebral palsy (CP). The purpose of this study was to investigate the factor structure of the WeeFIM in children with spastic CP. **Methods:** Two hundred seven children (138 boys, 69 girls) with spastic CP were recruited in this cross-sectional study; their mean age (SD) was 9.10 (2.7) years. Data were collected through a questionnaire that included the WeeFIM. Of the 207 children, 57 (27%), 105 (51%), and 45 (22%) were quadriplegic, diplegic, and hemiplegic, respectively. In each of these groups, 49 (24%), 32 (15%), 31 (15%), 19 (9%), and 76 (37%) children were classified as Gross Motor Function Classification System (GMFCS) levels I-V, respectively. The factor structure of the WeeFIM was analyzed by exploratory factor analysis (EFA) and confirmatory factor analysis (CFA) by using AMOS 20.0. The reliability of WeeFIM was assessed by calculating the internal consistency of Cronbach's α . **Results:** The internal consistency of Cronbach's α was 0.98. The 1- and 2-factor models did not demonstrate adequate fit indices according to CFA. However, the 3-factor structure (i.e. self-care, motor, and cognitive factors) was supported by EFA and CFA, which explained 87.12% of the variance. The self-care factor included 6 items (eating, grooming, dressing upper, dressing lower, bathing, and toileting), the motor factor included 7 items (bladder and bowel management, bed/chair/wheelchair, toilet, tub/shower, walk/wheelchair, and stairs), and the cognitive factor included the same 5 items as the original cognitive domain. **Conclusion:** In children with spastic CP, 3 factors of the WeeFIM were determined by factor analysis. Therefore, self-care, motor, and cognitive domains should be treated as separate scales in children with spastic CP. [Box: see text].

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9. Qual Health Res. 2012 Dec 3. [Epub ahead of print]**Children and Youth With Disabilities: Innovative Methods for Single Qualitative Interviews.**

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There is a paucity of explicit literature outlining methods for single-interview studies with children, and almost none have focused on engaging children with disabilities. Drawing from a pilot study, we address these gaps by describing innovative techniques, strategies, and methods for engaging children and youth with disabilities in a single qualitative interview. In the study, we explored the beliefs, assumptions, and experiences of children and youth with cerebral palsy and their parents regarding the importance of walking. We describe three key aspects of our child-interview methodological approach: collaboration with parents, a toolkit of customizable interview techniques, and strategies to consider the power differential inherent in child-researcher interactions. Examples from our research illustrate what worked well and what was less successful. Researchers can optimize single interviews with children with disabilities by collaborating with family members and by preparing a toolkit of customizable interview techniques.

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Prevention and Cure

10. *Dev Med Child Neurol.* 2012 Dec 5. doi: 10.1111/dmcn.12027. [Epub ahead of print]

Reduced satellite cell population may lead to contractures in children with cerebral palsy.

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Aim: Satellite cells are the stem cells residing in muscle responsible for skeletal muscle growth and repair. Skeletal muscle in cerebral palsy (CP) has impaired longitudinal growth that results in muscle contractures. We hypothesized that the satellite cell population would be reduced in contracted muscle. **Method:** We compared the satellite cell populations in hamstring muscles from participants with CP contracture (n=8; six males, two females; age range 6-15y; Gross Motor Function Classification System [GMFCS] levels II-V; 4 with hemiplegia, 4 with diplegia) and from typically developing participants (n=8; six males, two females, age range 15-18y). Muscle biopsies were extracted from the gracilis and semitendinosus muscles and mononuclear cells were isolated. Cell surface markers were stained with fluorescently conjugated antibodies to label satellite cells (neural cell adhesion molecule) and inflammatory and endothelial cells (CD34 and CD4 respectively). Cells were analyzed using flow cytometry to determine cell populations. **Results:** After gating for intact cells a mean of 12.8% (SD 2.8%) were determined to be satellite cells in typically developing children, but only 5.3% (SD 2.3%; p<0.05) in children with CP. Hematopoietic and endothelial cell types were equivalent in typically developing children and children with CP (p>0.05) suggesting the isolation procedure was valid. **Interpretation:** A reduced satellite cell population may account for the decreased longitudinal growth of muscles in CP that develop into fixed contractures or the decreased ability to strengthen muscle in CP. This suggests a unique musculoskeletal disease mechanism and provides a potential therapeutic target for debilitating muscle contractures.

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11. *BMJ.* 2012 Dec 4;345:e7961. doi: 10.1136/bmj.e7961.

Neurological and developmental outcome in extremely preterm children born in England in 1995 and 2006: the EPICure studies.

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OBJECTIVE: To determine outcomes at age 3 years in babies born before 27 completed weeks' gestation in 2006, and to evaluate changes in outcome since 1995 for babies born between 22 and 25 weeks' gestation. **DESIGN:** Prospective national cohort studies, EPICure and EPICure 2. **SETTING:** Hospital and home based evaluations, England. **PARTICIPANTS:** 1031 surviving babies born in 2006 before 27 completed weeks' gestation. Outcomes for 584 babies born at 22-25 weeks' gestation were compared with those of 260 surviving babies of the same gestational age born in 1995. **MAIN OUTCOME MEASURES:** Survival to age 3 years, impairment (2008 consensus definitions), and developmental scores. Multiple imputation was used to account for the high proportion of missing data in the 2006 cohort. **RESULTS:** Of the 576 babies evaluated after birth in 2006, 13.4% (n=77) were categorised as having severe impairment and 11.8% (n=68) moderate impairment. The prevalence of neurodevelopmental impairment was significantly associated with length of gestation, with greater impairment as gestational age decreased: 45% at 22-23 weeks, 30% at 24 weeks, 25% at 25 weeks, and 20% at 26 weeks (P<0.001). Cerebral palsy was present in 83 (14%) survivors. Mean developmental quotients were lower than those of the general population (normal values 100 (SD 15)) and showed a direct relation with gestational age: 80 (SD 21) at 22-23 weeks, 87 (19) at 24 weeks, 88 (19) at 25 weeks, and 91 (18) at 26 weeks. These results did not differ significantly after imputation. Comparing imputed outcomes between the 2006 and 1995 cohorts, the proportion of survivors

born between 22 and 25 weeks' gestation with severe disability, using 1995 definitions, was 18% (95% confidence interval 14% to 24%) in 1995 and 19% (14% to 23%) in 2006. Fewer survivors had shunted hydrocephalus or seizures. Survival of babies admitted for neonatal care increased from 39% (35% to 43%) in 1995 to 52% (49% to 55%) in 2006, an increase of 13% (8% to 18%), and survival without disability increased from 23% (20% to 26%) in 1995 to 34% (31% to 37%) in 2006, an increase of 11% (6% to 16%). CONCLUSION: Survival and impairment in early childhood are both closely related to gestational age for babies born at less than 27 weeks' gestation. Using multiple imputation to account for the high proportion of missing values, a higher proportion of babies admitted for neonatal care now survive without disability, particularly those born at gestational ages 24 and 25 weeks.

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12. Dev Med Child Neurol. 2012 Dec 4. doi: 10.1111/dmcn.12047. [Epub ahead of print]

Brain imaging in cerebral palsy.

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