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Professor Nadia Badawi AM

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Interventions and Management

1. Normative data of muscle fiber diameter of vastus lateralis during childhood: a field test.

Valentine J, Dyke J, Ward R, Thornton A, Blair E, Stannage K, Elliott C, Fabian V.

Muscle Nerve. 2019 Jan 25. doi: 10.1002/mus.26426. [Epub ahead of print]

INTRODUCTION: Currently, our knowledge of standard data for muscle morphology in children is largely limited to the 1969 paper of Brooke and Engel (BE). In 2016 we reported normal muscle morphology from vastus lateralis biopsies in ambulant children with cerebral palsy (CP). This report compares our normal biopsy results against BE standard value criteria. **METHODS:** A single blind prospective cross-sectional study design. **RESULTS:** Biopsies taken in ambulant children with CP were normal on morphometry, light and electron microscopy, however only 5 of 10 fulfilled the BE standard value criteria. **DISCUSSION:** This short report highlights the need for contemporary age specific normative data from a larger number of biopsies, including typically developing children. Review of the literature suggests biopsy material may be available from typically developing children who were control patients in research trials. This morphometric data could contribute to expanding the normative data set. This article is protected by copyright. All rights reserved.

PMID: [30680744](#)

2. Analysis of the electromyographic activity of lower limb and motor function in hippotherapy practitioners with cerebral palsy.

Ribeiro MF, Espindula AP, Lage JB, Bevilacqua Júnior DE, Diniz LH, Mello EC, Ferreira AA, Ferraz MLF, Teixeira VPA.

J Bodyw Mov Ther. 2019 Jan;23(1):39-47. doi: 10.1016/j.jbmt.2017.12.007. Epub 2017 Dec 9.

OBJECTIVE: Investigation of the effects of hippotherapy treatment on lower limb muscle activity and gross motor function in subjects with cerebral palsy (CP), comparing them to a group of subjects with adequate motor development. **METHODS:** Evaluation was made of seven individuals with spastic diparetic CP, average age 9.3 (± 3.3) years (CP group), Gross Motor Function Classification System (GMFCS) levels I and II, and eight individuals with adequate motor development, average age 10.9 (± 3.2) years (control group). The groups were submitted to 25 sessions of hippotherapy, each lasting 30 min, on a weekly basis, and the muscle activity of the lower limbs was evaluated using surface electromyography during the 1st, 10th, 20th, and 25th sessions. For the CP group, Gross Motor Function Measurement (GMFM-88) was performed before and after hippotherapy treatment. **RESULTS:** There was higher muscle activity in the 10th session, compared to the other sessions, with greater activity of the tibialis anterior muscles, for both groups studied. After treatment, the CP group showed significant improvement in the GMFM total score, and in the scores for dimensions D and E. **CONCLUSION:** Hippotherapy sessions improved the muscle responses in both groups, and improved the gross motor function of the subjects with CP.

PMID: [30691759](#)

3. Computational and experimental evaluation of the mechanical properties of ankle foot orthoses: A literature review.

Ielapi A, Forward M, De Beule M.

Prosthet Orthot Int. 2019 Jan 31:309364618824452. doi: 10.1177/0309364618824452. [Epub ahead of print]

BACKGROUND: Ankle foot orthoses are external medical devices applied around the ankle joint area to provide stability to patients with neurological, muscular, and/or anatomical disabilities, with the aim of restoring a more natural gait pattern. **STUDY DESIGN:** This is a literature review. **OBJECTIVES:** To provide a description of the experimental and computational methods present in the current literature for evaluating the mechanical properties of the ankle foot orthoses. **METHODS:** Different electronic databases were used for searching English-language articles realized from 1990 onward in order to select the newest and most relevant information available. **RESULTS:** A total of 46 articles were selected, which describe the different experimental and computational approaches used by research groups worldwide. **CONCLUSION:** This review provides information regarding processes adopted for the evaluation of mechanical properties of ankle foot orthoses, in order to both improve their design and gain a deeper understanding of their clinical use. The consensus drawn is that the best approach would be represented by a combination of advanced computational models and experimental techniques, capable of being used to optimally mimic real-life conditions. **CLINICAL RELEVANCE:** In literature, several methods are described for the mechanical evaluation of ankle foot orthoses (AFOs); therefore, the goal of this review is to guide the reader to use the best approach in the quantification of the mechanical properties of the AFOs and to help gaining insight in the prescription process.

PMID: [30700213](#)

4. The impact of ankle-foot orthosis stiffness on gait: A systematic literature review.

Total D, Menon M, Jones-Hershinow C, Barton K, Gates DH.

Gait Posture. 2019 Jan 15;69:101-111. doi: 10.1016/j.gaitpost.2019.01.020. [Epub ahead of print]

BACKGROUND: Ankle-foot orthoses (AFOs) are commonly prescribed to provide ankle support during walking. Current prescription standards provide general guidelines for choosing between AFO types, but are limited in terms of guiding specific design parameter choices. These design parameters affect the ankle stiffness of the AFO. **RESEARCH QUESTION:** The aim of this review was to investigate the impact of AFO stiffness on walking mechanics. **METHODS:** A literature search was conducted using three databases: Pubmed, Engineering Village, and Web of Science. **RESULTS:** After applying the exclusion criteria, 25 of 287 potential articles were included. The included papers tested a range of stiffnesses (0.02-8.17 Nm/deg), a variety of populations (e.g. healthy, post-stroke, cerebral palsy) and various gait outcome measures. Ankle kinematics were the most frequently reported measures and the most consistently affected by stiffness variations. Greater stiffnesses generally resulted in reduced peak ankle plantarflexion, dorsiflexion, and total range of motion, as well as increased dorsiflexion at initial contact. At the knee, a few studies reported increased flexion at initial contact, and decreased peak extension and increased peak flexion during stance when stiffness was increased. Stiffness did not affect hip kinetics and there was low evidence for its effects on hip or pelvis kinematics, ankle and knee kinetics, muscle activity, metabolic cost, ground reaction forces and spatiotemporal parameters. There were no generalizable trends for the impact of stiffness on user preference. **SIGNIFICANCE:** AFO stiffness is a key factor influencing ankle movement. Clear reporting standards for AFO design parameters, as well as additional high quality research is needed with larger sample sizes and different clinical populations to ascertain the true effect of stiffness on gait.

PMID: [30708092](#)

5. Evaluation of biomechanical gait parameters of patients with Cerebral Palsy at three different levels of gait assistance using the CPWalker.

Aycardi LF, Cifuentes CA, Múnica M, Bayón C, Ramírez O, Lerma S, Frizera A, Rocon E.

J Neuroeng Rehabil. 2019 Jan 28;16(1):15. doi: 10.1186/s12984-019-0485-0.

BACKGROUND: Cerebral Palsy (CP) is the most common cause of permanent serious physical disability in childhood. Although many platforms have been developed, so far there are still not precise guidelines for the rehabilitation of the population with CP. The CPWalker is a robotic platform for the rehabilitation of children with CP, through which they can start experiencing autonomous locomotion in the rehabilitation environment. It allows the possibility of free movement and includes physical and cognitive interfaces into the therapy. The main objective of this work is to evaluate the effects of the CPWalker-based rehabilitation intervention in children with CP by comparing different gait parameters before, during and after the use of

the platform. **FINDINGS:** The evaluation was divided in three stages where the gait parameters and symmetry indexes of eight subjects with CP were evaluated. In the first stage patients walked only with the help they receive normally in daily life. During the second stage they walked with the CPWalker and finally, in the third stage, they repeated their gait without the platform. In all stages they wore an inertial G-Sensor ® while walking through the hospital facilities. The results showed statistical significant differences in several spatio-temporal parameters, pelvic angles and general gait cycle parameters, with and without the use of the robotic device. For the eight patients: cadence, speed and stride length presented similar values when comparing before and after the therapy. However, they decreased during the intervention (both means and standard deviations). No significant differences were found in the symmetry indexes with the use of the platform. In spite of this, a reduction in the pelvic angles ranges and propulsion was observed. **CONCLUSIONS:** The effect of using the device was analyzed for spatio-temporal parameters, pelvic girdle angles and general gait cycle parameters. Among the eighteen initial parameters, seven presented a statistical significant difference when comparing stage 2 of the intervention with stages 1 and 3. Those changes showed the potential of the CPWalker to improve muscular strength and gait patterns of the patients with CP in the long term and to provide useful information for the design of the future generations of rehabilitation robotic devices.

PMID: [30691493](#)

6. Improving walking ability in people with neurological conditions: A theoretical framework for biomechanics driven exercise prescription.

Williams G, Hassett L, Clark R, Bryant A, Olver J, Morris ME, Ada L.

Arch Phys Med Rehabil. 2019 Jan 25. pii: S0003-9993(19)30075-9. doi: 10.1016/j.apmr.2019.01.003. [Epub ahead of print]

The purpose of this paper is to discuss how knowledge of the biomechanics of walking can be used to inform the prescription of resistance exercises for people with mobility limitations. Muscle weakness is a key physical impairment that limits walking in commonly occurring neurological conditions such as cerebral palsy, traumatic brain injury and stroke. Few randomised trials to date have shown conclusively that strength training improves walking in people living with these conditions. This appears to be because 1) the most important muscle groups for forward propulsion when walking have not been targeted for strengthening, and 2) strength training protocols have focused on slow and heavy resistance exercises, which do not improve the fast muscle contractions required for walking. We propose a theoretical framework to improve exercise prescription by integrating the biomechanics of walking with the principles of strength training outlined by the American College of Sports Medicine (ACSM), to prescribe exercises that are specific to improving the task of walking. The high angular velocities that occur in the lower limb joints during walking indicate that resistance exercises targeting power generation would be most appropriate. Therefore, we propose the prescription of plyometric and ballistic resistance exercise, applied using the ACSM guidelines for task-specificity, once people with neurological conditions are ambulating, to improve walking outcomes. This new theoretical framework for resistance training ensures that exercise prescription matches how the muscles work during walking.

PMID: [30690011](#)

7. Assessing the Validity of the MyJump2 App for Measuring Different Jumps in Professional Cerebral Palsy Football Players: An Experimental Study.

Coswig V, Silva AACE, Barbalho M, Faria FR, Nogueira CD, Borges M, Buratti JR, Vieira IB, Román FJL, Gorla JI.

JMIR Mhealth Uhealth. 2019 Jan 30;7(1):e11099. doi: 10.2196/11099.

BACKGROUND: Vertical jumps can be used to assess neuromuscular status in sports performance. This is particularly important in Cerebral Palsy Football (CP Football) because players are exposed to high injury risk, but it may be complicated because the gold standard for assessing jump performance is scarce in field evaluation. Thus, field techniques, such as mobile apps, have been proposed as an alternative method for solving this problem. **OBJECTIVE:** This study aims to evaluate the reliability of the measures of the MyJump2 app to assess vertical jump performance in professional CP Football. **METHODS:** We assessed 40 male CP Football athletes (age 28.1 [SD 1.4] years, weight 72.5 [SD 6.2] kg, and height 176 [SD 4.2] cm) through the countermovement jump (CMJ) and squat jump (SJ) using a contact mat. At the same time, we assessed the athletes using the MyJump2 app. **RESULTS:** There were no significant differences between the instruments in SJ height ($P=.12$) and flight time ($P=.15$). Additionally, there were no significant differences between the instruments for CMJ in jump height ($P=.16$) and flight time ($P=.13$). In addition, it was observed that there were significant and strong intraclass correlations in all SJ variables varying from 0.86 to 0.89 (both $P<.001$), which was classified as "almost perfect." Similar results were observed in all variables from the CMJ, varying from 0.92 to 0.96 (both $P \leq .001$). **CONCLUSIONS:** We conclude that the MyJump2 app presents high validity and reliability for measuring jump height and flight time of the SJ and CMJ in CP Football athletes.

PMID: [30698529](#)

8. Do adolescents with cerebral palsy meet recommendations for healthy weight and physical activity behaviours?

Williams SA, McFadden LM, Blackmore AM, Davey P, Gibson N.

Disabil Rehabil. 2019 Jan 26;1-6. doi: 10.1080/09638288.2018.1519043. [Epub ahead of print]

PURPOSE: Describe physical activity energy expenditure, body composition, and nutritional intake in adolescents with cerebral palsy (CP) in the context of health recommendations. **MATERIALS AND METHODS:** A cross-sectional study of 12 adolescents, aged 12-19 years, with CP, classified as Gross Motor Function Classification System levels II-V. Actiheart® accelerometry assessed daily physical activity energy expenditure; Dual Energy X-ray Absorptiometry (DXA) and skinfold assessment measured percentage body fat; the Modified Nutrition Questionnaire for children aged 12-18 years assessed nutritional intake. **RESULTS:** These adolescents spent per day a median of 413.3 min in sedentary (range: 90.0-621.9), 206.2 min in light activity (range: 48.4-509.5), and 65.5 min in moderate-vigorous physical activity (MVPA) (range: 9.4-363.9). Sixty-four percent of the participants met guidelines for time spent in MVPA, only one participant (9%) met the target for sedentary behaviour, and one (9%) participant reached all of the nutritional targets. Participants had a median percentage body fat of 43% by DXA and 40.3% by skinfold assessment. Seventy-three percent of the participants were classed as having a potentially unhealthy body composition according to percentage body fat. **CONCLUSIONS:** Adolescents with CP may have a high percentage body fat, and high levels of both sedentary activity and moderate-vigorous physical activity. Implications for rehabilitation Cerebral palsy specific strategies to decrease time in sedentary activity need to be determined as adolescents were not meeting national guidelines, however, most did meet guidelines for time spent in moderate to vigorous physical activity. Percentage body fat should be monitored in adolescents with cerebral palsy, as adolescents with cerebral palsy tend to have a high body fat ratio, despite some recording Body Mass Index within a healthy range. Triceps and subscapular skinfold assessment accurately assess percentage body fat in adolescents with cerebral palsy.

PMID: [30686039](#)**9. Improving nutritional status of children with Cerebral palsy: a qualitative study of caregiver experiences and community-based training in Ghana.**

Donkor CM, Lee J, Lelijveld N, Adams M, Baltussen MM, Nyante GG, Kerac M, Polack S, Zuurmond M.

Food Sci Nutr. 2018 Nov 15;7(1):35-43. doi: 10.1002/fsn3.788. eCollection 2019 Jan.

BACKGROUND: Cerebral palsy (CP) is the most common childhood disability worldwide, and evidence shows that children with CP are at an increased risk of malnutrition due to feeding difficulties. This qualitative study explores caregiver experiences of feeding before and after a community-based training program in Ghana. **METHODS:** Thirteen caregivers of children with CP, who were severely undernourished, were interviewed at the start of the training program. Eleven of these were interviewed again after a year of monthly group trainings and home visits, which included guidance on feeding. Four additional caregivers were interviewed at end line. Interviews explored caregivers' mealtime experiences, as well as a 24-hr dietary recall and a structured feeding observation checklist. Children's nutritional status was assessed by anthropometry. **RESULTS:** Caregivers found mealtimes stressful due to time demands, messiness, and the pressure of providing enough quality food. They felt that the training program had helped reduced this stress and dietary recall data suggested some improved dietary quality. However, there was neither improvement nor deterioration in anthropometric status of the children. **CONCLUSION:** Group trainings were welcomed by caregivers and notably reduced stress around feeding times. However, future work is needed in order to improve anthropometric outcomes, including, but not limited to, greater focus on nutritional requirements during caregiver training interventions. Therapeutic feeding programs must also be better utilized and need to be better equipped to care for this group of children, including deviating from standard admission and treatment protocols.

PMID: [30680157](#)**10. Dose, timing, and source of protein intake of young people with spastic cerebral palsy.**

Anker-van der Wel I, Smorenburg ARP, de Roos NM, Verschuren O.

Disabil Rehabil. 2019 Jan 29;1-6. doi: 10.1080/09638288.2018.1558291. [Epub ahead of print]

PURPOSE: Since the dose, timing and source of dietary protein intake are important for muscle growth and development, the aim of this study was to examine the dose, timing and source of protein intake of young people with cerebral palsy. **MATERIALS AND METHODS:** Dietary intake was assessed in 19 children with spastic cerebral palsy (Gross Motor Function Classification System levels I-V; Eating and Drinking Classification System levels I-V; 10 males, 9 females; mean [SD] age 11

years 2 months [3 years 3 months]) using a 3-day food diary. The data were analyzed for three age categories (4-8, 9-13, and 14-17 years). RESULTS: Average 3-day protein intake (62.1 g [27.9 g]) was within the recommended boundaries with a minimum of 1.0 g/kg body weight/day and a maximum of 4.1 g/kg body weight/day. However, dinner was the only mealtime that provided at least 25 g of protein, which is needed for optimal muscle maintenance. The main food groups that contributed to protein intake were 'milk and milk products', 'meat, meat products and poultry', and 'bread'. CONCLUSIONS: These observations suggest timing of protein intake can be improved with higher intakes during breakfast and lunch to better support skeletal muscle growth and development. IMPLICATIONS FOR REHABILITATION Recent studies have shown that smaller muscles and early atrophy are already present at young age in individuals with cerebral palsy. Besides physical training, adequate protein intake (with optimal dose, timing and source of protein) may be a key factor in the prevention and treatment of loss of muscle mass in children with cerebral palsy. In a relatively small sample this study shows that overall protein intake (dose) was in line with recommendations and also that the source of the protein seemed sufficient to contain all essential amino acids. Improvement of the timing of protein intake throughout the day, with higher intakes during breakfast and lunch, seems important to better support skeletal muscle growth and development.

PMID: [30696294](#)

11. Internet delivery of intensive speech and language therapy for children with cerebral palsy: a pilot randomised controlled trial.

Pennington L, Stamp E, Smith J, Kelly H, Parker N, Stockwell K, Aluko P, Othman M, Brittain K, Vale L.

BMJ Open. 2019 Jan 30;9(1):e024233. doi: 10.1136/bmjopen-2018-024233.

OBJECTIVES: To test the feasibility of recruitment, retention, outcome measures and internet delivery of dysarthria therapy for young people with cerebral palsy in a randomised controlled trial. DESIGN: Mixed methods. Single blind pilot randomised controlled trial, with control offered Skype therapy at end of study. Qualitative study of the acceptability of therapy delivery via Skype. SETTING: Nine speech and language therapy departments in northern England recruited participants to the study. Skype therapy was provided in a university setting. PARTICIPANTS: Twenty-two children (14 M, 8 F) with dysarthria and cerebral palsy (mean age 8.8 years (SD 3.2)) agreed to take part. Participants were randomised to dysarthria therapy via Skype (n=11) or treatment as usual (n=11). INTERVENTIONS: Children received either usual speech therapy from their local therapist for 6 weeks or dysarthria therapy via Skype from a research therapist. Usual therapy sessions varied in frequency, duration and content. Skype dysarthria therapy focused on breath control and phonation to produce clear speech at a steady rate, and comprised three 40 min sessions per week for 6 weeks. PRIMARY AND SECONDARY OUTCOME MEASURES: Feasibility and acceptability of the trial design, intervention and outcome measures. RESULTS: Departments recruited two to three participants. All participants agreed to random allocation. None withdrew from the study. Recordings of children's speech were made at all time points and rated by listeners. Families allocated to Skype dysarthria therapy judged internet delivery of the therapy to be acceptable. All families reported that the study design was acceptable. Treatment integrity checks suggested that the phrases practised in one therapy exercise should be reduced in length. CONCLUSIONS: A delayed treatment design, in which dysarthria therapy is offered at the end of the study to families allocated to treatment as usual, is acceptable. A randomised controlled trial of internet delivered dysarthria therapy is feasible.

PMID: [30705241](#)

12. Parental Satisfaction with Ambulatory Anesthesia during Dental Treatment for Disabled Individuals and Their Preference for Same in Future.

Ohtawa Y, Yoshida M, Fukuda K.

Bull Tokyo Dent Coll. 2019 Jan 31. doi: 10.2209/tdcpubliation.2018-0011. [Epub ahead of print]

The purpose of this study was to survey parental satisfaction with ambulatory anesthesia during dental treatment in disabled patients. Factors associated with parental preference for general anesthesia during future dental treatment in such patients were also investigated. A questionnaire was mailed to the parents of 181 disabled individuals who underwent dental treatment under ambulatory anesthesia at Tokyo Dental College Suidobashi Hospital between 2012 and 2016. A total of 71 responses were received (39.2%). The mean patient age was 18 years, and disabilities included autism spectrum disorder, intellectual disability, cerebral palsy, and epilepsy. The items surveyed included dental treatment details, number of times patients received general anesthesia, type of anesthetic used, anesthesia induction method, durations of treatment and anesthesia, and the presence or absence of intraoperative or postoperative complications. Questionnaire items queried problems related to dental care, anesthesia history, preoperative anxiety, length of fasting period, induction of general anesthesia, nursing and hospital room environment, postoperative anxiety, overall evaluation, and whether the parent would prefer general anesthesia during future dental treatment. The patients were divided into 2 groups: those whose parents preferred general anesthesia during future dental

treatment and those whose parents did not. The results revealed that, where disabled individuals had previously received general anesthesia during dental treatment, the parents were more likely to prefer general anesthesia during future dental treatment.

PMID: [30700644](#)

13. Use of clowns to attenuate pain and anxiety in children during botulinum toxin injections.

Houx L, Amandine Dubois A, Brochard S, Pons C.

Ann Phys Rehabil Med. 2019 Jan 29. pii: S1877-0657(19)30011-9. doi: 10.1016/j.rehab.2018.12.004. [Epub ahead of print]

OBJECTIVE: Botulinum toxin injection (BTI) is the primary treatment for spasticity in children. Anxiety and pain are important concerns to address to attenuate the discomfort of BTI. The aim of this study was to compare the effectiveness of medical clowns and usual distractions, both added to nitrous oxide (N₂O) and analgesic cream, on pain and anxiety during BTI sessions in children. **METHODS:** The primary outcome was pain evaluated by the Face, Legs, Activity, Cry, Consolability (FLACC) scale. Secondary criteria were pain rated on a visual analog scale (VAS) by the child and parent, anxiety rated on a VAS before and during BTIs by the child and parent(s), rating of the success of the sessions on a 4-point Likert scale by the physician and parent(s), and rating of the benefits of the distraction by the parent(s). Non-parametric tests were used for between-group comparisons. **RESULTS:** Baseline group characteristics of the clown and control groups did not differ. During 88 BTI sessions (40 with clown distraction and 48 with control distraction) in 59 children (35 boys; 52 with cerebral palsy, 12 with moderate to severe cognitive disorders), median maximal FLACC score was 2.5 (interquartile range [IQR] 1-4) in the clown group and 3 (IQR 1-4.3) in the control group. VAS self-reported pain score was 2.5 (IQR 0-5) and 3 (IQR 1-6.3) in the clown and control groups ($p=0.56$), and VAS proxy-reported pain score was 2.5 (IQR 0.3-3.4) and 3 (IQR 1-4.5) ($p=0.25$). After BTI sessions, the 2 groups did not differ in VAS self- and proxy-reported anxiety ($p=0.83$ and $p=0.81$). Physician and parent ratings of the success of sessions were similar between the groups ($p=0.89$ and $p=0.11$). Parent ratings of the perceived benefits of distraction were higher in the clown than control group ($p=0.004$). **CONCLUSIONS:** Although clown distraction was particularly appreciated by parents, it did not significantly reduce pain or anxiety in children as compared with usual distraction.

PMID: [30708069](#)

14. Paediatric emergency department presentations due to feeding tube complications in children with cerebral palsy.

Wong AL, Meehan E, Babl FE, Reid SM, Catto-Smith A, Williams K, Reddihough DS.

J Paediatr Child Health. 2019 Jan 30. doi: 10.1111/jpc.14386. [Epub ahead of print]

AIM: To describe the characteristics of emergency department (ED) presentations due to complications from gastrostomy or gastrojejunal feeding tubes among children with cerebral palsy (CP), the complexity of complications and the management approaches taken. **METHODS:** The Victorian CP Register was linked to the ED databases of Victoria's two tertiary paediatric hospitals, and data on presentations due to feeding tube complications were identified based on discharge diagnosis codes. Additional data on presentations were extracted from medical records. **RESULTS:** Over 5 years, there were 234 ED presentations due to feeding tube-related complaints among a CP cohort ($n = 2183$). ED notes were located for 183 of the 234 presentations. The majority of presentations (90%) involved children with severe gross motor impairment. A total of 46% of presentations ($n = 84$) was triaged as lower urgency, and 68% ($n = 124$) took place between 08:00 am and 06:00 pm. The most common presenting complaint was tube dislodgement ($n = 105$; 70%). No investigations were recorded in the majority of cases, and in almost 90% of cases, the feeding tube was successfully replaced in the ED, usually by an ED physician ($n = 74$) and less frequently by a surgeon ($n = 9$), gastroenterologist ($n = 2$) or nurse ($n = 8$); 9% ($n = 17$) resulted in a hospital admission. **CONCLUSIONS:** Most ED presentations due to feeding tube complaints in children with CP are in children with severe gross motor impairment but are able to be managed in the ED. As such, it is likely that care givers and other health professionals could manage some of the complications experienced in primary health-care settings closer to home.

PMID: [30697863](#)

15. Optimal Management of Undescended Testis in Boys with Cerebral Palsy. A Debate.

Springer A.

Sex Dev. 2019 Feb 1. doi: 10.1159/000496463. [Epub ahead of print]

Cerebral palsy is a rare condition following injury of the developing brain and including nonprogressive neurological disorders, spasticity, intellectual impairment and others. Boys with cerebral palsy have a high incidence of undescended testis. Although the motives for treatment (infertility, cancer prevention, psychological aspects, testicular torsion) are not different in boys without neurological impairment, the decision-making process in boys with cerebral palsy is very difficult. Besides medical and surgical arguments the discussion involves challenging ethical issues.

PMID: [30703771](#)

16. [Clinical experience of using zonisamide in structural focal epilepsy in children with cerebral palsy].

Badalyan OL, Trepilets VM, Trepilets SV.

Zh Nevrol Psikhiatr Im S S Korsakova. 2018;118(10. Vyp. 2):90-97. doi: 10.17116/jnevro201811810290. [Article in Russian; Abstract available in Russian from the publisher]

AIM: To evaluate the efficacy and safety of zonisamide as an add-on therapy in structural focal epilepsy in children with cerebral palsy (CP). MATERIAL AND METHODS: Sixty-four patients (36 boys and 28 girls) with spastic CP and structural focal epilepsy with refractory seizures were followed up. Patients received zonisamide in a dose of 6-8.8 mg/kg/day for ≥ 6 months. Treatment efficacy was assessed by the reduction of seizures depending on CP form, type of epileptic seizures, combination of zonisamide with other drugs and adverse-effects. RESULTS AND CONCLUSION: A reduction of seizures by $\geq 50\%$ was identified in 60.9% of children, 10.9% showed a better recovery. The best efficacy (35.9%) was demonstrated in the treatment of generalized seizures with focal onset and in the combination with levetiracetam (35.9%). Adverse effects of mild to moderate severity were noted in 26.5% of children. The treatment was discontinued in 7.8%. Therefore, zonisamide is an effective treatment for refractory structural focal epilepsy in children with CP and comorbid pathology, which reduces the frequency of seizures without severe side-effects.

PMID: [30698551](#)

17. Efficacy of acupotomy for cerebral palsy: A systematic review and meta-analysis.

Kwon CY, Lee B, Chang GT, Yoon SH.

Medicine (Baltimore). 2019 Jan;98(4):e14187. doi: 10.1097/MD.00000000000014187.

BACKGROUND: In children, cerebral palsy (CP) is one of the most common causes of irreversible neurological sequelae. Acupotomy, a modernized acupuncture form combining the effects of microsurgery and conventional acupuncture, may show specific benefits in the treatment of CP, especially with respect to spasticity. The aim of this review was to evaluate the efficacy of acupotomy for CP. METHODS: Eleven databases were comprehensively searched from their inception dates to November 27, 2018. Randomized controlled trials (RCTs) or quasi-RCTs evaluating acupotomy as a monotherapy or as adjunctive therapy to rehabilitation treatment for CP were included. The methodological quality of included studies was assessed using the risk of bias tool. The quality of evidence for each main outcome was evaluated using the Grading of Recommendations Assessment, Development, and Evaluation approach. Meta-analysis was performed, and the pooled data were presented as mean difference (MD) with 95% confidence interval (CI) for continuous outcomes and as risk ratio (RR) with 95% CI for dichotomous outcomes. RESULTS: Eight studies involving 530 participants were included. In 1 study, acupotomy was associated with significantly higher total effective rate (TER) compared with Bobath ($P < .01$). Acupotomy combined with rehabilitation was associated with significantly higher TER (RR 1.24, 95% CI 1.01-1.52, $I^2 = 77\%$) and gross motor function measure score (MD 12.62, 95% CI 11.75-13.49, $I^2 = 54\%$), and significantly lower muscle tone of gastrocnemius measured by the Ashworth scale or the modified Ashworth scale (MD -0.97, 95% CI -1.07 to -0.88, $I^2 = 0\%$) compared with rehabilitation alone. No studies reported the incidence of adverse events. The methodological quality of the included studies and quality of evidence for the main finding were generally low. CONCLUSION: Current evidence shows that acupotomy as a monotherapy or as adjunctive therapy to rehabilitation treatment might have benefits in the treatment of CP. However, due to the small number of studies included, the lack of sample size, poor methodological qualities, and low quality of evidence, the findings of this review should be interpreted with caution. Larger and more rigorous, high-quality RCTs should be performed on this topic. PROSPERO REGISTRATION NUMBER: CRD42018105891.

PMID: [30681588](#)

18. ACOG Committee Opinion No. 766 Summary: Approaches to Limit Intervention During Labor and Birth.

[No authors listed]

Obstet Gynecol. 2019 Feb;133(2):406-408. doi: 10.1097/AOG.0000000000003081.

Obstetrician-gynecologists, in collaboration with midwives, nurses, patients, and those who support them in labor, can help women meet their goals for labor and birth by using techniques that require minimal interventions and have high rates of patient satisfaction. Many common obstetric practices are of limited or uncertain benefit for low-risk women in spontaneous labor. For women who are in latent labor and are not admitted to the labor unit, a process of shared decision making is recommended to create a plan for self-care activities and coping techniques. Admission during the latent phase of labor may be necessary for a variety of reasons, including pain management or maternal fatigue. Evidence suggests that, in addition to regular nursing care, continuous one-to-one emotional support provided by support personnel, such as a doula, is associated with improved outcomes for women in labor. Data suggest that for women with normally progressing labor and no evidence of fetal compromise, routine amniotomy need not be undertaken unless required to facilitate monitoring. The widespread use of continuous electronic fetal monitoring has not been shown to significantly affect such outcomes as perinatal death and cerebral palsy when used for women with low-risk pregnancies. Multiple nonpharmacologic and pharmacologic techniques can be used to help women cope with labor pain. Women in spontaneously progressing labor may not require routine continuous infusion of intravenous fluids. For most women, no one position needs to be mandated or proscribed. Obstetrician-gynecologists and other obstetric care providers should be familiar with and consider using low-interventional approaches, when appropriate, for the intrapartum management of low-risk women in spontaneous labor. Birthing units should carefully consider adding family-centric interventions that are otherwise not already considered routine care and that can be safely offered, given available environmental resources and staffing models. These family-centric interventions should be provided in recognition of the value of inclusion in the birthing process for many women and their families, irrespective of delivery mode. This Committee Opinion has been revised to incorporate new evidence for risks and benefits of several of these techniques and, given the growing interest on the topic, to incorporate information on a family-centered approach to cesarean birth.

PMID: [30681540](#)**19. Determinants of Health-related Quality of Life Among Mothers of Children With Cerebral Palsy.**

Lee MH, Matthews AK, Park C.

J Pediatr Nurs. 2019 Jan - Feb;44:1-8. doi: 10.1016/j.pedn.2018.10.001. Epub 2018 Oct 11.

PURPOSE: Caring for a child with cerebral palsy (CP) can impact both the physical and mental health of parents. However, determinants associated with health-related quality of life (HRQOL) in these parents have yet to be adequately examined. The study aims were to identify the determinants affecting HRQOL among mothers of children with CP. **DESIGN AND METHODS:** Participants in this cross-sectional study (N = 180) were mothers of children with CP recruited from clinical and school-based settings in Korea. Variables examined were characteristics of child (demographic factors and disability parameter), mother (demographic factors, number of chronic conditions, health-promoting behaviors (HPB), and parenting stress), and environmental factors (use of personal assistant care, leisure time and social support). Multivariate regression analysis was performed to examine the child, mother, and environmental factors associated with HRQOL. **RESULTS:** The HRQOL results revealed that the physical HRQOL was higher than mental HRQOL in the sample. Longer length of disability of children and lower number of chronic conditions of mothers were significant factors of higher physical HRQOL. Lower parenting stress, more leisure time, engagement in HPB, and greater social support were significantly associated with higher mental HRQOL. **CONCLUSIONS:** The levels of HRQOL of mothers of children with CP were very low and our findings suggest modifiable factors. Decreasing parenting stress, engaging in HPB, and providing social support should be considered when developing psychosocial intervention for this population. **PRACTICE IMPLICATIONS:** Study results may inform programs aimed at health promotion, stress reduction, and QOL improvement among parents of children with disabilities.

PMID: [30683274](#)**20. Distinct neuroimaging features of DDHD2 gene-related spastic paraplegia, a mimicker of cerebral palsy.**

Thabet F, Tlili-Graïess K, Tabarki B.

Arch Dis Child. 2019 Jan 31. pii: archdischild-2018-316484. doi: 10.1136/archdischild-2018-316484. [Epub ahead of print]

PMID: [30705080](#)

21. Small interstitial 9p24.3 deletions principally involving KANK1 are likely benign copy number variants.

Wallis MJ, Boys A, Tassano E, Delatycki MB.

Eur J Med Genet. 2019 Jan 23. pii: S1769-7212(18)30541-X. doi: 10.1016/j.ejmg.2019.01.008. [Epub ahead of print]

A small heterozygous deletion involving KANK1 was originally reported in 2005 to cause cerebral palsy in one large Israeli family of Jewish Moroccan origin. There were nine affected children over two generations to five unaffected fathers. All of these children had congenital hypotonia that evolved into spastic quadriplegia over the first year of life, along with intellectual impairment and brain atrophy. The subsequent clinical depictions of other individuals with neurological disease harbouring a comparable KANK1 deletion have been extremely variable and most often quite dissimilar to the original family. The reported pathogenicity of these deletions has also been variable, due to an inconsistent nature of reported disease associations and limited data. We therefore sought to perform a review of the significance of small distal interstitial chromosome 9p24.3 deletions principally involving KANK1, including data from the VCGS cytogenetics laboratory. We found that carrier parents do not appear to display an increased frequency of neurological disease, individuals with a small KANK1 deletion have sometimes been found to have an alternate genetic diagnosis that explained their neurological condition, and small KANK1 deletions can be seen with approximate equal frequency in case and control populations. These data led us to conclude that small deletions involving KANK1 do not cause a highly-penetrant influence of large effect size and they are unlikely to contribute significantly to the aetiology of disease in patients with development delay, intellectual disability, autism or cerebral palsy. We recommend searching for an alternate explanation for disease in individuals with a neurological disorder found to have a small deletion involving KANK1.

PMID: [30684669](#)**22. Mirror movements in children with unilateral cerebral palsy due to perinatal stroke: clinical correlates of plasticity reorganization.**

Riddell M, Kuo HC, Zewdie E, Kirton A.

Dev Med Child Neurol. 2019 Jan 28. doi: 10.1111/dmcn.14155. [Epub ahead of print]

AIM: We aimed to determine if the mirror movements that often result in children with unilateral cerebral palsy (CP) after perinatal stroke represent a clinical biomarker of developmental plasticity. **METHOD:** This was a prospective, controlled cohort study. Mirror movements in children with unilateral CP from a population-based cohort were compared to those of typically developing controls. The population with stroke was assessed further via electromyography (EMG), motor function, and corticospinal organization investigations. Mirror movements were quantified (0-5) bidirectionally. EMG mirror movements were quantified during voluntary contraction. Motor function was quantified by validated measures including the Assisting Hand Assessment (AHA). Corticospinal organization was categorized as ipsilateral or contralateral using transcranial magnetic stimulation (TMS). The relationships between mirror movements, function, and corticospinal organization were assessed (t-tests, Pearson rank correlation coefficients). **RESULTS:** Ninety-two participants were scored (55 males, 37 females, mean [SD] 12y [5y 6mo], range 4-17y), 63 with complete motor outcomes and 39 with TMS data. EMG ratios correlated with clinical mirror movements ($r=0.562$, $p=0.008$). Mild mirror activity in controls declined with age ($r=-0.459$, $p<0.001$). Mirroring was stronger with tasks performed by the affected hand ($p<0.001$). Mirror movements correlated with AHA scores ($r=-0.255$, $p=0.04$) and poor motor outcome ($p<0.001$). Unaffected hand mirror activity was higher in children with ipsilateral corticospinal tract arrangements ($p<0.001$). **INTERPRETATION:** Clinical mirror movements correlate with disability and corticospinal organization in children with unilateral CP with perinatal stroke. This simple bedside biomarker could facilitate patient selection for personalized rehabilitation. **WHAT THIS PAPER ADDS:** Mirror movements are a clinical indicator of corticospinal organization in children with unilateral cerebral palsy with perinatal stroke. Mirroring is strongest in children with ipsilateral corticospinal tract reorganization. The concept of a 'directionality factor' to mirror movements highlights additional, clinically relevant functional correlations.

PMID: [30690708](#)

Prevention and Cure

23. Spinal Hyper-Excitability and Altered Muscle Structure Contribute to Muscle Hypertonia in Newborns After Antenatal Hypoxia-Ischemia in a Rabbit Cerebral Palsy Model.

Synowiec S, Lu J, Yu L, Goussakov I, Lieber R, Drobyshevsky A.

Front Neurol. 2019 Jan 17;9:1183. doi: 10.3389/fneur.2018.01183. eCollection 2018.

Rabbit kits after global antenatal hypoxic-ischemic injury exhibit motor deficits similar to humans with cerebral palsy. We tested several mechanisms previously implicated in spinal hyper-excitability after perinatal brain injury that may explain muscle hypertonia in newborns. Stiffness of hind limb muscles during passive stretch, electromyogram, and spinal excitability by Hoffman reflex, were assessed in rabbit kits with muscle hypertonia after global hypoxic-ischemic brain injury and naïve controls. Affected muscle architecture, motoneuron morphology, primary afferents density, gliosis, and KCC2 expression transporter in the spinal cord were also examined. Decrease knee stiffness after anesthetic administration was larger, but residual stiffness was higher in hypertonic kits compared to controls. Hypertonic kits exhibited muscle shortening and atrophy, in both agonists and antagonists. Sarcomere length was longer in tibialis anterior in hypertonic kits than in controls. Hypertonic kits had decreased rate dependent depression and increased Hmax/Mmax in H-reflex. Motor neuron soma sizes, primary afferent density were not different between controls and hypertonic kits. Length of dendritic tree and ramification index were lower in hypertonic group. Gene expression of KCC2 was lower in hypertonic kits, but protein content was not different between the groups. In conclusion, while we found evidence of decreased supraspinal inhibitory control and increased excitability by H-reflex that may contribute to neuronal component in hypertonia, increased joint resistance to stretch was explained predominantly by changes in passive properties of muscles and joints. We did not find structural evidence of increased sensory afferent input or morphological changes in motoneurons that might explain increased excitability. Gliosis, observed in spinal gray matter, may contribute to muscle hypertonia.

PMID: [30705663](#)

24. Postnatal Paraclinical Parameters Associated to Occurrence of Intracerebral Hemorrhage in Preterm Infants.

Lampe R, Turova V, Botkin N, Eckardt L, Felderhoff-Müser U, Rieger-Fackeldey E, Alves-Pinto A, Kovtanyuk A, Sidorenko I.

Neuropediatrics. 2019 Jan 29. doi: 10.1055/s-0038-1677515. [Epub ahead of print]

Intracerebral hemorrhage (ICH) is the most frequent complication in postnatal development of preterm infants. The purpose of the present work is the statistical evaluation of seven standard paraclinical parameters and their association to the development of ICH. Clinical records of 265 preterm infants with gestational age (GA) 23 to 30 weeks were analyzed. According to ICH status, patients were divided into control (without ICH) and affected (with ICH) groups. Mean values of paraclinical parameters at each week of gestation were compared. Different ICH grades, periods before and after ICH were considered separately. Lower hematocrit, SaO₂, and pH were statistically significant for preterm infants with 23 to 30 weeks GA and diagnosis of ICH relative to infants without ICH. Additionally, for preterm infants with 27 to 30 weeks GA, higher C-reactive protein, as well as lower values of thrombocytes were associated with the occurrence of ICH. Preterm infants with 23 to 26 weeks GA showed C-reactive protein values similar to those in the group without ICH and lower levels of thrombocytes after bleeding. Significant differences in paraclinical parameters between preterm infants with and without ICH may constitute useful indicators for closer clinical observation of preterm infants at risk of ICH.

PMID: [30695800](#)