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Interventions and Management

1. Scalp acupuncture for children with cerebral palsy: A protocol for a systematic review.

Lee GE, Lee PT, Ran N, Zhou J.

Medicine (Baltimore). 2019 Nov;98(48):e18062. doi: 10.1097/MD.00000000000018062.

BACKGROUND: Cerebral palsy (CP) describes a group of permanent disorders of movement and posture causing activity limitations, leading the most common movement disorder to children. Scalp acupuncture (SA) is one of several specialized acupuncture techniques, and it has been used widely in China to alleviate several CP symptoms, despite the deficiency of high-quality evidence related to this practice. Therefore, we plan to conduct a protocol of systematic review aimed at systematically reviewing all the clinical evidence on the effectiveness of scalp acupuncture for treating CP in children.

METHODS: The following electronic databases will be searched from inception to May 1, 2019 MEDLINE, PubMed, Web of Science, EMBASE, the Cochrane Central Register of Controlled Trials (Cochrane Library), Chinese National Knowledge Infrastructure (CNKI), Chinese Scientific Journals Database (VIP), Wan-fang Database, and Chinese Biomedical Literature Database (CBM). All published English and Chinese articles randomized controlled trials (RCTs) will be included. All types of CP of children in the trials will be included in this study and these individuals will be involved as core searchers to evaluate the efficacy of scalp acupuncture. Rev Man V.5.3 software will be implemented for the assessment of bias risk, data synthesis, subgroup analysis, and meta-analyses if inclusion conditions are met. Continuous outcomes will be presented as mean difference (MD) or standard mean difference (SMD), while dichotomous data will be expressed as a relative risk. **RESULTS:** The systematic review will synthesize the available knowledge surrounding scalp acupuncture for children with CP. The findings will be synthesized to determine the efficacy and safety of scalp acupuncture for children with CP. **CONCLUSION:** This protocol will present the evidence of whether scalp acupuncture is an effective intervention for children with CP.

PMID: [31770222](#)

2. Osteoporosis Epidemiology Among Adults With Cerebral Palsy: Findings From Private and Public Administrative Claims Data.

French ZP, Caird MS, Whitney DG.

JBMR Plus. 2019 Oct 7;3(11):e10231. doi: 10.1002/jbm4.10231. eCollection 2019 Nov.

Individuals with cerebral palsy (CP) have an increased risk for the early development of osteoporosis; however, little is known about the epidemiology of osteoporosis for adults with CP, which is vital to inform clinical practice for osteoporosis prevention, treatment, and management. The purpose of this cross-sectional study was to determine sex-stratified prevalence of osteoporosis among adults with CP, as compared with adults without CP. Data from 2016 were extracted from Optum Clinformatics Data Mart (private insurance administrative claims data) and a random 20% sample from the fee-for-service Medicare (public insurance administrative claims data). Diagnostic codes were used to identify CP and osteoporosis

diagnoses. Sex-stratified prevalence of osteoporosis was compared between adults with and without CP for the following age groups: 18 to 30, 31 to 40, 41 to 50, 51 to 60, 61 to 70, and >70 years of age. The overall prevalence of osteoporosis was 4.8% for adults without CP (n = 8.7 million), 8.4% for privately insured adults with CP (n = 7,348), and 14.3% for publicly insured adults with CP (n = 21,907). Women and men with CP had a higher prevalence of osteoporosis compared with women and men without CP for all age groups. Finally, publicly insured women and men with CP had a higher prevalence of osteoporosis compared with privately insured women and men with CP for all age groups, except for the similar prevalence among the 18- to 30-year age group. These findings suggest that osteoporosis is more prevalent among adults with CP compared with adults without CP. Study findings highlight the need for earlier screening and preventive medical services for osteoporosis management among adults with CP. © 2019 The Authors. JBMR Plus published by Wiley Periodicals, Inc. on behalf of American Society for Bone and Mineral Research.

PMID: [31768490](#)

3. An alternative fixation method for femoral varus derotational osteotomy in spastic cerebral palsy: the Rush rod.

Deignan BJ, Washburn S, Pilc E, Tuten HR.

J Pediatr Orthop B. 2020 Jan;29(1):22-28. doi: 10.1097/BPB.0000000000000649.

The objective of this study is to present the clinical and radiographic data collected from patients who were treated with a varus derotational osteotomy using Rush rod fixation and compare this to published norms of outcomes using blade plate fixation. A retrospective chart and radiograph review was conducted after identifying 44 patients with 61 hips who underwent varus derotational osteotomy with Rush rod fixation at our institution between 2006 and 2016. We identified 44 patients with 61 hips who underwent the procedure. Information from follow-up clinic visits was gathered and any complications were noted. The patients' radiographs were analyzed to measure neck-shaft angle, center-edge angle, and acetabular index. At the time of surgery, 44 patients (61 hips) also had soft tissue releases performed, 44 (61 hips) had an open reduction of the hip, and 39 (55 hips) had Dega acetabular osteotomies performed as well. The average pre-operative neck-shaft angle was measured at 163.0° (range 128-180) with average post-operative neck-shaft angles measuring 111.3° (range 85-167). The acetabular index improved from an average of 33.3° (range 16-60) to 16.4 (range 4-35). Post-operative Center-Edge Angle measured 29.7° (range 5-45). There were no infections or cases of avascular necrosis of the femoral head. We present an alternative fixation method for performing varus derotational osteotomy of the proximal femur in children with cerebral palsy using the Rush rod. In our retrospective analysis of 61 hips undergoing this procedure, we present comparable radiographic outcomes with decreased complication rates. Level of evidence: Retrospective comparative study to previously published results, Level III.

PMID: [31770291](#)

4. Musculoskeletal Imaging in Cerebral Palsy.

Schroeder KM, Heydemann JA, Beauvais DH.

Phys Med Rehabil Clin N Am. 2020 Feb;31(1):39-56. doi: 10.1016/j.pmr.2019.09.001. Epub 2019 Nov 6.

Scoliosis, hip dysplasia, and other lower extremity deformities are common musculoskeletal pathology found in patients with cerebral palsy. Imaging studies allow for an improved identification of patients with these issues, help to understand the pathology, and aid in planning treatment strategies. Most of these deformities are visualized using plain radiographic techniques. Occasionally, as in the case of preoperative planning, advanced imaging, such as computerized topography and MRI, can be used for additional information. This article provides insight into the various imaging techniques for these musculoskeletal issues and aids in better care for patients with cerebral palsy.

PMID: [31760993](#)

5. Using accelerometry for measurement of motor behavior in children: Relationship of real-world movement to standardized evaluation.

Hoyt CR, Brown SK, Sherman SK, Wood-Smith M, Van AN, Ortega M, Nguyen AL, Lang CE, Schlaggar BL, Dosenbach NUF.

Res Dev Disabil. 2019 Nov 26;96:103546. doi: 10.1016/j.ridd.2019.103546. [Epub ahead of print]

BACKGROUND: When detected, children with asymmetrical motor impairment are referred for therapeutic interventions to maximize the child's ability to reach their health and developmental potential. Referral is dependent on standardized evaluation, which rarely examines upper extremity (UE) function within the context of real-world activity. Accelerometry provides an efficient method to objectively measure movement in children. The purpose of this study was to compare accelerometry to clinical assessment, specifically the Melbourne Assessment of Unilateral Upper Limb Function-2 (MA-2). **METHODS:** A total of 52 children between 1-17 years of age with asymmetrical motor deficits and age matched controls participated in this study. Participants wore bilateral accelerometers for 4 x 25 h. The use ratio (UR) and mono-arm use index (MAUI) were calculated to quantify asymmetrical impairment. The Melbourne Assessment of Unilateral Upper Limb Function-2 (MA-2) was administered and compared to accelerometry variables. **RESULTS:** The UR and MAUI were significantly different in children with and without deficits. The MAUI was significantly correlated with all domains of the MA-2: accuracy ($r = 0.44$, $p = 0.026$); fluency ($r = 0.52$, $p = 0.006$); dexterity ($r = 0.53$, $p = 0.005$); and range of motion ($r = 0.49$, $p = 0.011$). **CONCLUSIONS:** Our findings suggest a relationship between real-world movement and clinical evaluation.

PMID: [31783278](#)

6. Asymmetry in children with unilateral cerebral palsy during sit-to-stand movement: Cross-sectional, repeated-measures and comparative study.

Dos Santos AN, Pena GM, Guilherme EM, Rocha NACF.

Clin Biomech (Bristol, Avon). 2019 Nov 13;71:152-159. doi: 10.1016/j.clinbiomech.2019.11.007. [Epub ahead of print]

BACKGROUND: We aimed to compare motor strategies adopted by children with unilateral Cerebral Palsy and typically developing children during the performance of sit-to-stand. **METHODS:** Eleven children with unilateral cerebral palsy and 20 typically developing children were evaluated. Kinematic and kinetic analysis of the sit-to-stand movement was performed. Three seat heights were evaluated: neutral (90° of hip-knee-ankle flexion), elevated to 120% of the neutral height, and lowered to 80% of the neutral height. As outcome variables, we considered sit-to-stand duration (temporal); initial, final and maximal sagittal angles and range of motion of trunk, pelvis, hip, knee, and ankle (kinematics); the peak of vertical ground reaction force (kinetics), and asymmetric index. Effect size is represented by η^2p . **FINDINGS:** We found that for the lowered seat, all groups presented increased flexion of lower limbs and trunk to initiate sit-to-stand ($p \leq 0.012$; $\eta^2p = 0.41-0.84$), increased peak flexion of trunk, hip and knee ($p \leq 0.01$; $\eta^2p = 0.39-0.88$), increased range of motion of knee and trunk ($p \leq 0.01$; $\eta^2p = 0.45-0.85$) and the duration of sit-to-stand ($p \leq 0.05$ $\eta^2p = 0.23-0.56$). Children with unilateral cerebral palsy presented increased posterior pelvic tilt ($p \leq 0.01$) and decreased hip flexion of both lower limbs ($p \leq 0.01$) for all seat heights and moved their non-affected limb backward in the lowered seat ($p \leq 0.01$). Asymmetry was observed for the final and the maximal angles of the ankle in neutral and lowered seats in unilateral cerebral palsy (asymmetry index = 3.3-5.8%). **INTERPRETATION:** The lowered seat height led to adaptive motor strategies in children with unilateral cerebral palsy, which should be considered in clinical practice.

PMID: [31760324](#)

7. The Role of Motion Analysis in Surgical Planning for Gait Abnormalities in Cerebral Palsy.

Dugan EL, Shilt JS.

Phys Med Rehabil Clin N Am. 2020 Feb;31(1):107-115. doi: 10.1016/j.pmr.2019.09.009. Epub 2019 Nov 8.

Gait abnormalities in cerebral palsy are complex and difficult to accurately characterize. Clinical gait analysis shows the prerequisite components of a clinical test to aid in the treatment planning for patients with cerebral palsy. Clinical gait analysis can be used to distinguish between different levels of impairment, can be used to monitor progress and outcomes, and is beginning to show promise for prediction of postsurgical outcomes. Clinical gait analysis can also provide important and relevant information for treatment planning, enhance the likelihood of positive outcomes, and reduce the number of negative outcomes.

PMID: [31760984](#)

8. Gait analysis - Available platforms for outcome assessment.

Klöpper-Krämer I, Brand A, Wackerle H, Müßig J, Kröger I, Augat P.

Injury. 2019 Nov 11. pii: S0020-1383(19)30708-9. doi: 10.1016/j.injury.2019.11.011. [Epub ahead of print]

Movement or gait analysis has become a viable assessment tool not only used in sports science or basic biomechanical research, but has also expanded to be a very valuable instrument in clinical diagnostics, monitoring functional recovery and musculoskeletal rehabilitation. In this context, this method has long been an integral part solely in neurological disorders such as cerebral palsy. However, in the meantime the benefits have also become apparent in other medical areas, such as foot surgery, orthopaedic technology, or in patients after lower limb amputation. These procedures proved to better understand, objectify and quantify the individual causes of gait and movement disorders in order to optimize patient-specific therapy. Currently we are able to rely on a multitude of available measurement systems. These can either be used in everyday life for simple monitoring of one's own activity or to complement therapeutic approaches in the clinical and scientific environment. The following review highlights the various fields of movement analysis, including markerless motion capture, marker-based analysis, pedobarography and wearable sensors. Each of these areas presents its own field of application and potential usage as well as the advantages and disadvantages arising in this context. The following article will give an overview of the type of measurement technology used, the respective fields of application, and the selected parameters and their interpretation possibilities for each of the areas mentioned.

PMID: [31767371](#)

9. Characteristics of newly acquired gait in toddlers with unilateral cerebral palsy: Implications for early rehabilitation.
Grigoriu AI, Lempereur M, Bouvier S, Padure L, Brochard S.

Ann Phys Rehabil Med. 2019 Nov 26. pii: S1877-0657(19)30177-0. doi: 10.1016/j.rehab.2019.10.005. [Epub ahead of print]

BACKGROUND: Knowledge of the characteristics of newly acquired gait in toddlers with cerebral palsy (CP) is limited. **OBJECTIVES:** This study compared gait characteristics (spatiotemporal parameters, kinematics and lower-limb muscle activation) within the first 6 months of independent walking in toddlers with unilateral cerebral palsy (UCP) and typically developing (TD) children. **METHODS:** The gait of 28 TD toddlers and 13 toddlers with UCP, all up to 3 years old with maximum walking experience of 6 months, was recorded by using a 3-D optoelectronic system and surface electromyography (EMG). Statistical parametric mapping was used to compare the kinematic parameters and EMG envelopes. Mann-Whitney U test was used to compare spatiotemporal parameters between groups. Principal component analysis was used to determine whether the main kinematic results were related to the clinical measures. **RESULTS:** Toddlers with UCP had bilateral modifications of the spatiotemporal parameters during gait as compared with TD toddlers and temporal asymmetry. The largest kinematic difference between the UCP and TD groups was external pelvic rotation on the affected side (13.3°). Foot progression angle was external during swing phase on the affected side. The groups did not differ in muscle activation for the set of muscles recorded. Pelvic rotation was not associated with any of the clinical measures on the affected or non-affected sides of toddlers with UCP. **CONCLUSIONS:** Alterations in kinematic gait parameters were mostly found at the pelvis in toddlers with UCP and newly acquired gait. At that age, the external pelvic rotation on the affected side is more likely due to primary motor control disorders than compensatory mechanisms. These findings suggest that early rehabilitation should focus on proximal motor control, balance and symmetry to optimize gait development from the early stages in children with UCP.

PMID: [31783143](#)

10. Effects of soft tissue surgery on transverse kinematics in patients with cerebral palsy.
Park BS, Chung CY, Park MS, Lee KM, Cho SH, Sung KH.

BMC Musculoskelet Disord. 2019 Nov 27;20(1):566. doi: 10.1186/s12891-019-2955-8.

BACKGROUND: Gait disturbances, including flexed knee gait, stiff knee gait, and tip-toeing gait, are common in patients with cerebral palsy (CP). There has been no reports regarding kinematic changes in the transverse plane after soft tissue surgeries, such as distal hamstring lengthening (DHL), rectus femoris transfer (RFT), and tendo-Achilles lengthening (TAL). This study aimed to evaluate changes in the transverse plane after soft tissue surgery in patients with CP by assessing the effects of the DHL, RFT, and TAL. **METHODS:** The study enrolled 156 consecutive patients (mean age, 8.4 years; range, 4.4 to 20.9), representing 213 operated limbs, who underwent soft tissue surgery including DHL with semitendinosus transfer, RFT, and TAL. All patients were assessed by preoperative and 1-year postoperative three-dimensional gait analysis. Changes in transverse plane kinematics after soft tissue surgery and affecting factors were analyzed. **RESULTS:** Sagittal kinematics including knee flexion at initial contact, ankle dorsiflexion at initial contact, and mean ankle dorsiflexion in the stance phase were significantly improved after single event multilevel surgery (all $p < 0.001$). Transverse kinematics, including mean tibial rotation and foot progression angle, were significantly improved to a more external angle after soft tissue surgeries (-2.9°, $p = 0.004$ and -9.5°, $p < 0.001$). The mean hip rotation was significantly improved to a more external angle by RFT (-4.7°, $p = 0.010$) and the foot progression angle was significantly improved to a more external angle by TAL (-3.9°, $p = 0.028$). **CONCLUSIONS:** This study found that the transverse kinematics were improved to a more external angle after soft tissue surgery in patients with CP. Therefore, clinicians should consider that soft tissue surgery can affect the transverse plane

kinematics in patients with CP. To confirm our findings, further research regarding the natural history of femoral and tibial torsion in children with CP is needed.

PMID: [31775715](#)

11. Surgical Tone Reduction in Cerebral Palsy.

Thomas SP, Addison AP, Curry DJ.

Phys Med Rehabil Clin N Am. 2020 Feb;31(1):91-105. doi: 10.1016/j.pmr.2019.09.008. Epub 2019 Nov 8.

This article overviews the surgical options for hypertonia management in cerebral palsy, both spasticity and dystonia. We review the history and use of intrathecal baclofen. We contrast its use with the indications for selective dorsal rhizotomy and review how it is the optimal technique to lower tone in the ambulatory spastic diplegic patient with cerebral palsy. This article reviews the advent of deep brain stimulation, with an emphasis on selection criteria and expected outcomes in this population. The article reviews the principles and use of selective peripheral neurotomy as it is applied to focal spasticity not requiring systemic tone reduction.

PMID: [31760996](#)

12. Can pedobarography predict the occurrence of heel rocker in children with lower limb spasticity?

Mudge AJ, Sangeux M, Wojciechowski EA, Louey MG, McKay MJ, Baldwin JN, Dwan LN, Axt MW, Burns J.

Clin Biomech (Bristol, Avon). 2019 Oct 23;71:208-213. doi: 10.1016/j.clinbiomech.2019.10.022. [Epub ahead of print]

BACKGROUND: Pedobarography software calculates the centre-of-pressure trajectory in relation to the foot to quantify foot contact patterns. This study presents two new pedobarography measures using the centre-of-pressure trajectory to assess heel rocker. **METHODS:** To validate these pedobarography measures against 3D gait analysis, emed®-x and Vicon Nexus gait analysis data were captured from 25 children aged 8-16 years (11 male) with unilateral (n = 18) and bilateral (n = 7) cerebral palsy or acquired brain injury. 3D gait analysis identified whether heel rocker was intact (n = 22 feet) or absent (n = 28 feet) based on centre-of-pressure at initial contact and the ankle kinematic curve between 0 and 2% of the gait cycle. Pedobarography measures calculated from the initial centre-of-pressure point were the distance to the heel (point of initial contact) and to the most posterior point of the trajectory (rollback), reported as a percentage of foot length. **FINDINGS:** The median point of initial contact in limbs with an intact heel rocker was 9% (range 7-12%) and median rollback was 0% (range 0-0.2%), whereas the median point of initial contact in limbs with an absent heel rocker was 58% (range 8-78%) and rollback was 18% (range 0-40%). Point of initial contact is the more accurate method for predicting heel rocker, with a threshold of 14% of foot length identifying the correct heel rocker status in 94% of cases. **INTERPRETATION:** Point of initial contact can assess heel rocker with high accuracy. Both point of initial contact and rollback provide sensitive information on foot strike pattern, enhancing the utility of pedobarography.

PMID: [31783269](#)

13. Principles of Ankle-Foot Orthosis Prescription in Ambulatory Bilateral Cerebral Palsy.

Wright E, DiBello SA.

Phys Med Rehabil Clin N Am. 2020 Feb;31(1):69-89. doi: 10.1016/j.pmr.2019.09.007.

Maintenance of upright posture and gait mobility is frequently a goal in supporting children with cerebral palsy (CP). Ankle-foot orthoses (AFOs) can play an important role in normalizing gait function in this population. Properly designed orthotic interventions consider common ankle and foot deformities, range-of-motion limitations, and natural history of CP. Successful AFO prescription often requires interaction with complementary interventions such as physical therapy, spasticity management, and/or orthopedic management. Recognizing the impact of plantar flexion contractures and the effects of footwear on AFO alignment is key to effective orthotic management of gait dysfunction in children with CP.

PMID: [31760995](#)

14. Orthopedic Conditions in Adults with Cerebral Palsy.

Lomax MR, Shrader MW.

Phys Med Rehabil Clin N Am. 2020 Feb;31(1):171-183. doi: 10.1016/j.pmr.2019.09.013.

Orthopedic conditions are common in adults with cerebral palsy (CP). Although CP is argued to be a nonprogressive condition of the brain, the musculoskeletal components tend to worsen and deteriorate over time leading to chronic pain, function limitation, and a decline in mobility. Orthopedic care of adults with CP has not been well documented in the literature. This article describes the common orthopedic conditions in adults with CP and discusses who should perform orthopedic surgery on adults.

PMID: [31760990](#)**15. The Influence of Orthotics on Lower Limbs Biomechanics in CP.**

Krasowicz K.

Ortop Traumatol Rehabil. 2019 Oct 31;21(5):389-398.

The biomechanics of the human body has a direct impact on the quality of gait cycle. Patients with Cerebral Palsy (CP) often present incorrect gait patterns associated with structural deformities which directly influence the locomotor functions. The key to therapeutic success in those patients is the use of lower limb orthotics of the AFO type. This type of orthopedic devices should correct the skeletal deformities, optimize function and ensure high quality of daily use. Alignment of the lower limb supported by orthotics in all planes is crucial for changing the abnormal position of the ground reaction force (GRF) vector during a pathological gait cycle. GRFs produce an external moment of forces that causes extension or flexion of the lower limb in the sagittal plane. At the same time, those external conditions are balanced by an internal moment of forces generated by muscles. Some of the muscles are not directly attached to the joints but still support their function. This mechanism is called biomechanical coupling. This interesting relationship is also related to the inclination or reclination of the shank vertical angle (SVA) against the foot fixed on the ground in the midstance (MST) phase of gait. An optimal SVA angle is 7-12 degrees of tibial inclination. An insufficient or excessive SVA angle can be controlled by ankle foot orthotics (AFO). Those types of splints provide for better control of foot clearance during the swing phase and support distal stability of the lower limb chain during the stance phase of the gait cycle. An interdisciplinary approach is the key to success in the therapy of CP children who use lower limb orthotics. Nowadays, tridimensional gait analysis is an important tool for objective monitoring of those patients. It shows all kinematic and kinetic data recorded during gait with AFO and therefore helps to fine-tune orthotics used by CP patients.

PMID: [31774066](#)**16. Adaptive Sports, Arts, Recreation, and Community Engagement.**

Tow S, Gober J, Nelson MR.

Phys Med Rehabil Clin N Am. 2020 Feb;31(1):143-158. doi: 10.1016/j.pmr.2019.09.003. Epub 2019 Nov 7.

Adaptive sports and recreation have an important role in the lifestyle of individuals with cerebral palsy (CP). This article discusses the history of adaptive sports and the benefits of adaptive sports and recreation. Barriers and medical challenges are also thoroughly discussed, including common musculoskeletal issues, methods to prevent musculoskeletal injury, pain, fatigue, maximal exertion, and other medical comorbidities and illness. The role of health care providers such as physiatrists is emphasized to provide support to individuals with CP who either are interested in starting exercise or a sport or are already an athlete.

PMID: [31760987](#)**17. Functional Skills among Preschool Children with Cerebral Palsy - Assessment before and after Early Intervention.**

Sørensen K, Vestheim IE, Lerdal B, Skranes J.

Dev Neurorehabil. 2019 Nov 28:1-7. doi: 10.1080/17518423.2019.1698069. [Epub ahead of print]

Objective: To assess and evaluate the change in functional skills among children with cerebral palsy (CP) who participated in an intensified habilitation program. **Methods:** In this prospective longitudinal study, a cohort of 39 preschool children (2-5 years) with cerebral palsy (Gross Motor Function Classification System levels I-V) together with their parents participated in an intensified multidimensional habilitation program for 1 year. Activities strengthening functional skills were among the main interventions. The children were evaluated with the Pediatric Evaluation of Disability Inventory before and after the program period. **Results:** Only children at GMFCS levels I-II showed improvements in mobility and social function on norm-referenced scales. After the intervention period, these children scored similar to the mean for typically developing children of the same age on the social function domain. **Conclusions:** Functional skills among preschool children with CP, GMFCS levels I-II, seems strengthened after participation in an intensified habilitation program.

PMID: [31779501](#)

18. Botulinum Toxin Injection in Children with Hemiplegic Cerebral Palsy: Correction of Growth through Comparison of Treated and Unaffected Limbs.

Yi YG, Jang DH, Lee D, Oh JY, Han MH.

Toxins (Basel). 2019 Nov 23;11(12). pii: E688. doi: 10.3390/toxins11120688.

Botulinum toxin type A (BoNT-A) injections in children with cerebral palsy (CP) may negatively affect muscle growth and strength. We injected BoNT-A into the affected limbs of 14 children (4.57 ± 2.28 years) with hemiplegic CP and exhibiting tip-toeing gait on the affected side and investigated the morphological alterations in the medial head of the gastrocnemius muscle (GCM). We assessed thickness of the GCM, fascicle length, and fascicle angle on the affected and unaffected sides at baseline and 4 and 12 weeks after BoNT-A injections. The primary outcome measure was the change (percentage) in GCM thickness in the affected side treated with BoNT-A in comparison with the unaffected side. The percentage of treated GCM thickness became significantly thinner at 4 and 12 weeks after BoNT-A injection than baseline. However, the percentage of fascicle length and angle in treated limbs showed no significant change from baseline 4 and 12 weeks after the injection. BoNT-A injections might reduce muscle thickness in children with spastic hemiplegic CP. Fascicle length and angle might not be affected by BoNT-A injections after correction of normal growth of the children.

PMID: [31771177](#)

19. Online peer mentorship programs for children and adolescents with neurodevelopmental disabilities: A systematic review.

Saxena S, Mitchell J, Ehsan A, Majnemer A, Shikako-Thomas K.

Child Care Health Dev. 2019 Nov 29. doi: 10.1111/cch.12726. [Epub ahead of print]

BACKGROUND: Children and adolescents with neurodevelopmental disabilities may be less well integrated into their community than their peers. Online groups can be particularly accessible for individuals with neurodevelopmental disabilities, as individuals may be able to connect with a larger network than they would in their local community. This systematic review aimed at estimating the effectiveness of online peer mentorship programs on children and adolescent's participation in life situations. **METHODS:** A systematic review was conducted to search Medline, PsycINFO, Embase, CINAHL and Education Research Complete (ERIC) electronic databases. Thematic analysis was done for studies that used qualitative methodology. **RESULTS:** 11 articles were included and they examined the influences of five different structured online peer mentorship intervention programs and six different online support groups. The disabilities included cerebral palsy (n=3), autism spectrum disorder (n=3), spina bifida (n=2), attention deficit hyperactivity disorder (n=2), and other neurodevelopmental disorders. The mentors included in the studies were caregivers of children with disabilities, youth and adults with disabilities, and a virtual peer actor. The mentees included in the studies were youth with disabilities (age 10-19 years) and their families. Intervention characteristics varied across the studies, but consistently showed a unique potential to facilitate social networking and support. Intervention programs with specific content and structure showed better participation outcomes than unstructured interventions. Presence of a moderator and participant characteristics (age, socio-cultural background) were suggested to influence the outcomes of interventions. **CONCLUSIONS:** Online peer mentorship programs appear to have positive influence on social engagement and participation in life situation for children and adolescents with disabilities. This paper discusses several areas which should be considered in future research studies to improve potential effectiveness, and use of study designs that help to establish not only if interventions work, but for whom they work best and why.

PMID: [31782542](#)

20. Health-related quality of life, pain, and fatigue in young adults with cerebral palsy.

Jacobson DN, Löwing K, Tedroff K.

Dev Med Child Neurol. 2019 Nov 28. doi: 10.1111/dmcn.14413. [Epub ahead of print]

AIM: To describe health-related quality of life (HRQoL), pain, fatigue, and other health variables in young adults with cerebral palsy (CP), and to explore associations with the Gross Motor Function Classification System - Expanded and Revised (GMFCS-ER) and physical activity. **METHOD:** This was a cross-sectional study of 61 young adults at a mean age of 21 years 2 months (standard deviation 8mo, range 20-22y) with CP, from a geographically defined area. Data collection included: Short Form 36 version 2 for HRQoL, Brief Pain Inventory - Short Form, Fatigue Severity Scale, level of physical activity, medical history, and physical examination. **RESULTS:** Overall HRQoL equalled that of population norms; however self-reported physical health was lower in GMFCS-ER levels III to V compared to GMFCS-ER levels I to II. Self-reported mental health was, inversely, lower in GMFCS-ER levels I to II compared to GMFCS-ER levels III to V. Pain prevalence was 49%, and pain was present across all GMFCS-ER levels. Fatigue, as well as sleep problems, had 41% prevalence, with fatigue severity decreasing with increasing level of physical activity. **INTERPRETATION:** General HRQoL in young adults with CP was comparable to population norms. Pain and fatigue are important to address in high motor-functioning individuals also. Physical activity could be a possible protective factor against fatigue.

PMID: [31777955](#)

21. Quality of life outcomes after deep brain stimulation in dystonia: A systematic review.

Tsuboi T, Wong JK, Okun MS, Ramirez-Zamora A.

Parkinsonism Relat Disord. 2019 Nov 18. pii: S1353-8020(19)30492-4. doi: 10.1016/j.parkreldis.2019.11.016. [Epub ahead of print]

Dystonia is an incurable movement disorder which can cause not only physical but also mental problems, leading to impaired health-related quality of life (HRQoL). For patients with dystonia refractory to medical treatment, deep brain stimulation (DBS) is a well-established surgical treatment. The objective of this systematic review is to provide a better understanding of HRQoL outcomes after DBS for dystonia. A search of the literature was conducted using Medline (PubMed), Embase, and Cochrane Library databases in May 2019. HRQoL outcomes after DBS along with motor outcomes were reported in a total of 36 articles involving 610 patients: 21 articles on inherited or idiopathic isolated dystonia, 5 on tardive dystonia, 3 on cerebral palsy, 2 on myoclonus-dystonia, 1 on X-linked dystonia-parkinsonism, and 3 on mixed cohorts of different dystonia subtypes. DBS improved motor symptoms in various subtypes of dystonia. Most studies on patients with inherited or idiopathic isolated dystonia showed significant improvement in physical QoL, whereas gains in mental QoL were less robust and likely related to the complexity of associated neuropsychiatric problems. HRQoL outcomes beyond 5 years remain scarce. Although the studies on patients with other subtypes of dystonia also demonstrated improvement in HRQoL after DBS, the interpretation is difficult because of a limited number of articles with small cohorts. Most articles employed generic measures (e.g. Short Form Health Survey-36) and this highlights the critical need to develop and to utilize sensitive and disease-specific HRQoL measures. Finally, long-term HRQoL outcomes and predictors of HRQoL should also be clarified.

PMID: [31767450](#)

22. Responsiveness and minimal clinically important difference of TNO-AZL Preschool Children Quality of Life in children with cerebral palsy.

Chen CL, Shen IH, Huang HH, Chen CY, Hsiao YT, Wu CY, Chen HC.

Qual Life Res. 2019 Nov 28. doi: 10.1007/s11136-019-02370-y. [Epub ahead of print]

PURPOSE: To examine the responsiveness and minimal clinically important difference (MCID) of the TNO-AZL (Netherlands Organization for Applied Scientific Research Academic Medical Centre) Preschool Children Quality of Life (TAPQOL) in children with cerebral palsy (CP). **METHODS:** Ninety-seven children with CP (60 males, 37 females; aged 1-6 years) and their caregivers were recruited from the rehabilitation programs of Chang Gung Memorial Hospital in Taiwan for this 6-month longitudinal follow-up study. The Functional Independence Measure for Children (WeeFIM) and TAPQOL outcomes were measured at baseline and at a 6-month follow-up. Responsiveness was examined using the standardized response mean (SRM). The distribution-based and anchor-based MCID were determined. The TAPQOL outcomes include physical functioning (PF), social functioning (SF), cognitive functioning (CF), and emotional functioning (EF) domains. **RESULTS:** The responsiveness of the TAPQOL for all of TAPQOL domains was marked (SRM = 1.12-1.54). The anchor-based MCIDs of TAPQOL for PF, SF, CF, EF, and total domains were 1.25, 3.28, 2.93, 2.25, and 1.73, respectively, which were similar to the distribution-based

MCID values of TAPQOL, except in the PF domain. The distribution-based MCIDs of TAPQOL in various domains were 2.85-3.73 when effect size (ES) was 0.2, 7.13-9.32 when ES was 0.5, and 11.40-14.91 when ES was 0.8. CONCLUSIONS: TAPQOL is markedly responsive to detect change in children with CP. The caregivers perceived the minimally important change in HRQOL of their children at a relatively low treatment efficacy. Researchers and clinicians can utilize TAPQOL data to determine whether changes in TAPQOL scores indicate clinically meaningful effects post-treatment and at the follow-up.

PMID: [31782017](#)

23. A survey of bolus tube feeding prevalence and practice in adult patients requiring home enteral tube feeding.

Hubbard GP, Andrews S, White S, Simpson G, Topen S, Carnie L, Murphy C, Collins R, Davies J, Owen A, Barker J, Green L, Patel I, Ridgway J, Lenchner J, Faerber J, Pearce L, Meanwell H, Kominek N, Stark L, Best H, Simons R, Cross T, Stratton RJ.

Br J Nutr. 2019 Dec 14;122(11):1271-1278. doi: 10.1017/S000711451900223X.

Anecdotal evidence suggests the use of bolus tube feeding is increasing in the long-term home enteral tube feed (HETF) patients. A cross-sectional survey to assess the prevalence of bolus tube feeding and to characterise these patients was undertaken. Dietitians from ten centres across the UK collected data on all adult HETF patients on the dietetic caseload receiving bolus tube feeding (n 604, 60 % male, age 58 years). Demographic data, reasons for tube and bolus feeding, tube and equipment types, feeding method and patients' complete tube feeding regimens were recorded. Over a third of patients receiving HETF used bolus feeding (37 %). Patients were long-term tube fed (4.1 years tube feeding, 3.5 years bolus tube feeding), living at home (71 %) and sedentary (70 %). The majority were head and neck cancer patients (22 %) who were significantly more active (79 %) and lived at home (97 %), while those with cerebral palsy (12 %) were typically younger (age 31 years) but sedentary (94 %). Most patients used bolus feeding as their sole feeding method (46 %), because it was quick and easy to use, as a top-up to oral diet or to mimic mealtimes. Importantly, oral nutritional supplements (ONS) were used for bolus feeding in 85 % of patients, with 51 % of these being compact-style ONS (2.4 kcal (10.0 kJ)/ml, 125 ml). This survey shows that bolus tube feeding is common among UK HETF patients, is used by a wide variety of patient groups and can be adapted to meet the needs of a variety of patients, clinical conditions, nutritional requirements and lifestyles.

PMID: [31782379](#)

24. Oral health and nutritional status of children with cerebral palsy in northeastern peninsular Malaysia.

Ahmad R, Rahman NA, Hasan R, Yaacob NS, Ali SH.

Spec Care Dentist. 2019 Nov 27. doi: 10.1111/scd.12436. [Epub ahead of print]

AIMS: To investigate the oral health and nutritional status of children with cerebral palsy (CP). METHODS AND RESULTS: Oral health assessment included dental caries and dental plaque maturity scores (DPMS) while the nutritional assessment included children's height-for-age Z-score (HAZ), body mass index-for-age Z-score (BAZ), mid-upper-arm circumference (MUAC), nutrient intake, cariogenic food frequency (CFF) and daily sugar exposure (DSE). Ninety-three CP children were recruited. The prevalence of caries was 81.7% (95% CI: 72.7%-88.3%). The median (IQR) of the DMFT and dft scores were 0.5(4.0) and 3.0(8.0), respectively. Most of the participants had acid-producing plaque (90.3%), severely stunted (81.4%), and 45% were severely thin with acute malnutrition. Intakes of calcium, iron, zinc, vitamin A, vitamin D and total fat were below 77% of the Recommended Nutrient Intakes for Malaysian children (RNI 2017). Nine types of cariogenic foods/drinks were consumed moderately, and DSE indicated that 45% of the children were at moderate risk of dental caries. CONCLUSION: Untreated dental caries, severe stunting and thinness were prevalent, and cariogenic foods/drinks were consumed moderately suggesting a moderate risk of caries. Therefore, controlling cariogenic food intake is crucial, but monitoring daily nutrient intake is needed for the optimum growth of children with CP.

PMID: [31774579](#)

25. Treatment with the essential amino acid L-tryptophan reduces masticatory impairments in experimental cerebral palsy.

Lacerda DC, Manhães-de-Castro R, Gouveia HJCB1, Tourneur Y, Costa de Santana BJ, Assunção Santos RE, Olivier-Coq J, Ferraz-Pereira KN, Toscano AE.

Nutr Neurosci. 2019 Nov 26:1-13. doi: 10.1080/1028415X.2019.1695360. [Epub ahead of print]

Purpose Children with cerebral palsy (CP) often exhibit difficulties in feeding resulting from deficits in chewing. This study investigates the therapeutic potential of L-tryptophan (TRI) to reduce deficits in chewing in rats subjected to an experimental model of CP. **Methods** A total of 80 Wistar albino rats were used. Pups were randomly assigned to 4 experimental groups: Control Saline, Control TRI, CP Saline, and CP TRI groups. The experimental model of CP was based on the combination of perinatal anoxia associated with postnatal sensorimotor restriction of the hind limbs. TRI was administered subcutaneously during the lactation period. Anatomical and behavioral parameters were evaluated during maturation, including body weight gain, food intake, chewing movements, relative weight and the distribution of the types of masseter muscle fibers. **Results** The induction of CP limited body weight gain, decreased food intake and led to impairment in the morphological and functional parameters of chewing. Moreover, for a comparable amount of food ingested, CP TRI animals grew the most. In addition, supplementation with TRI improved the number of chewing movements, and increased the weight and proportion of type IIB fibers of the masseter in rats subjected to CP. **Conclusion** These results demonstrate that experimental CP impaired the development of mastication and that TRI supplementation increased masticatory maturation in animals subjected to CP.

PMID: [31766953](#)

26. Optimizing Nutrition and Bone Health in Children with Cerebral Palsy.

Jesus AO1, Stevenson RD2.

Phys Med Rehabil Clin N Am. 2020 Feb;31(1):25-37. doi: 10.1016/j.pmr.2019.08.001. Epub 2019 Nov 6.

Children with cerebral palsy (CP) are at risk of growth and nutrition disorders. There are numerous challenges to measure and assess growth and nutritional status in children with CP. Addressing these challenges is imperative, because the consequences of poor growth and malnutrition range from decreased bone density, muscle mass, and quality of life to impacts on intellectual quotient, behavior, attention, social participation, healthcare utilization, and health care costs. In addition to discussing approaches to assess growth and nutrition, this article examines some of the methods of optimizing nutrition and bone health, including when preparing for and recovering from surgery.

PMID: [31760992](#)

27. Contribution of extracellular matrix components to the stiffness of skeletal muscle contractures in patients with cerebral palsy.

Smith LR, Pichika R, Meza RC, Gillies AR, Baliki MN, Chambers HG, Lieber RL.

Connect Tissue Res. 2019 Nov 28:1-12. doi: 10.1080/03008207.2019.1694011. [Epub ahead of print]

Purpose: Joint contractures in children with cerebral palsy contain muscle tissue that is mechanically stiffer with higher collagen content than typically developing children. Interestingly, the correlation between collagen content and stiffness is weak. To date, no data are available on collagen types or other extracellular matrix proteins in these muscles, nor any information regarding their function. Thus, our purpose was to measure specific extracellular protein composition in cerebral palsy and typically developing human muscles along with structural aspects of extracellular matrix architecture to determine the extent to which these explain mechanical properties. **Materials and Methods:** Biopsies were collected from children with cerebral palsy undergoing muscle lengthening procedures and typically developing children undergoing anterior cruciate ligament reconstruction. Tissue was prepared for the determination of collagen types I, III, IV, and VI, proteoglycan, biglycan, decorin, hyaluronic acid/uronic acid and collagen crosslinking. **Results:** All collagen types increased in cerebral palsy along with pyridinoline crosslinks, total proteoglycan, and uronic acid. In all cases, type I or total collagen and total proteoglycan were positive predictors, while biglycan was a negative predictor of stiffness. Together these parameters accounted for a greater degree of variance within groups than across groups, demonstrating an altered relationship between extracellular matrix and stiffness with cerebral palsy. Further, stereological analysis revealed a significant increase in collagen fibrils organized in cables and an increased volume fraction of fibroblasts in CP muscle. **Conclusions:** These data demonstrate a novel adaptation of muscle extracellular matrix in children with cerebral palsy that includes alterations in extracellular matrix protein composition and structure related to mechanical function.

PMID: [31779492](#)

28. Tone Reduction and Physical Therapy: Strengthening Partners in Treatment of Children with Spastic Cerebral Palsy.

Franki I, Bar-On L, Molenaers G, Van Campenhout A, Craenen K, Desloovere K, Feys H, Pauwels P, De Cat J, Ortibus E.

Neuropediatrics. 2019 Nov 27. doi: 10.1055/s-0039-3400987. [Epub ahead of print]

The aim of this paper is to provide a clinically applicable overview of different tone reducing modalities and how these can interact with or augment concurrent physical therapy (PT). Botulinum toxin (BoNT), oral tone-regulating medication, intrathecal baclofen (ITB), and selective dorsal rhizotomy are discussed within a physiotherapeutic context and in view of current scientific evidence. We propose clinical reasoning strategies to identify treatment goals as well as the appropriate and corresponding treatment interventions. Instrumented measurement of spasticity, standardized clinical assessment, and 3D clinical motion analysis are scientifically sound tools to help select the appropriate treatment and, when needed, to selectively target or spare individual muscles. In addition, particular attention is given to strength training as a necessary tool to tackle muscle weakness associated with specific modalities of tone reduction. More research is needed to methodologically assess the long-term effectiveness of such individualized tone treatment, optimize parameters such as medication dosage, and gain more insight into the kind of PT techniques that are essential in conjunction with tone reduction.

PMID: [31777043](#)

29. Two-year outcomes of infants enrolled in the first-in-human study of amnion cells for bronchopulmonary dysplasia.
Malhotra A, Lim R, Mockler JC, Wallace EM.

Stem Cells Transl Med. 2019 Nov 27. doi: 10.1002/sctm.19-0251. [Epub ahead of print]

We previously reported on the immediate safety and neonatal outcomes of six premature infants with severe bronchopulmonary dysplasia (BPD) who were administered human amnion epithelial cells (hAECs). One infant died in the neonatal period due to unrelated causes. In this study, we aimed to assess the long-term safety and follow-up outcomes of the five surviving infants until 2 years corrected age (CA). hAECs were administered intravenously at a dose of 1×10^6 cells per kilogram after 36 weeks postconceptional age in infants with established BPD. Study follow-up consisted of assessment of any adverse events, growth, and respiratory, cardiac, and neurodevelopmental outcomes over four time points (6, 12, 18, and 24 months CA). Investigations included chest x-rays, cranial and abdominal ultrasounds, and echocardiograms at regular intervals as well as a magnetic resonance imaging (MRI) brain at 2 years CA. All five infants were alive at 2 years CA. Median time to wean off oxygen was 24 (10-36) months. Two infants had pulmonary hypertension, which resolved by 2 years of age. Four infants were rehospitalized briefly for viral or bacterial infections during the 2 years. MRI brain findings included normal ($n = 1$), and mild to moderate white matter loss ($n = 2$). Neurodisabilities diagnosed included hemiplegic cerebral palsy ($n = 1$), global developmental delay ($n = 3$), and severe hearing loss ($n = 3$). No evidence of tumor formation was noted on physical examinations or on any imaging. There were no long-term adverse events observed that could be attributed to hAEC administration. We observed long-term effects of extreme prematurity and severe BPD in the cohort.

PMID: [31774236](#)

30. Technological Advancements in Cerebral Palsy Rehabilitation.
Reyes F, Niedzwecki C, Gaebler-Spira D.

Phys Med Rehabil Clin N Am. 2020 Feb;31(1):117-129. doi: 10.1016/j.pmr.2019.09.002. Epub 2019 Nov 6.

Smaller, smarter, more portable rehabilitation technology has the potential to improve the ability of individuals with cerebral palsy to perform activities and increase participation. Robotics and virtual reality may improve movement by maximizing exercise dose, providing feedback, and motivating users. Augmentative and alternative communication technology is facilitating communication. Robots can help with self-care and provide encouragement and instruction in rehabilitation programs. Mobile applications can provide education and resources. Conducting high-quality research to validate technological advances in our field has been a major focus of researchers and advocacy groups.

PMID: [31760985](#)

31. Visuospatial Attention and Saccadic Inhibitory Control in Children with Cerebral Palsy.
Maioli C, Falciati L, Galli J, Micheletti S, Turetti L, Balconi M, Fazzi EM.

Front Hum Neurosci. 2019 Nov 8;13:392. doi: 10.3389/fnhum.2019.00392. eCollection 2019.

Cerebral palsy (CP) is a non-progressive syndrome due to a pre-, peri- or post-natal brain injury, which frequently involves an impairment of non-motor abilities. The aim of this article was to examine visuospatial attention and inhibitory control of prepotent motor responses in children with CP showing a normal IQ or mild cognitive impairment, measuring their performance in oculomotor tasks. Ten children (9-16-year-old) with spastic CP and 13 age-matched, typically developing children (TDC) participated in the study. Subjects performed a simple visually-guided saccade task and a cue-target task, in which they performed a saccade towards a peripheral target, after a non-informative visual cue was flashed 150 ms before the imperative target, either at the same (valid) or at a different (invalid) spatial position. Children with CP showed severe executive deficits in maintaining sustained attention and complying with task instructions. Furthermore, saccadic inhibitory control appeared to be significantly impaired in the presence of both stimulus-driven and goal-directed captures of attention. In fact, patients showed great difficulties in suppressing saccades not only to the cue stimuli but also to the always-present target placeholders, which represented powerful attentional attractors that had to be covertly attended throughout the task execution. Moreover, impairment did not affect in equal manner the whole visual field but showed a marked spatial selectivity in each individual subject. Saccade latencies in the cue-target task were faster in the valid than in the invalid condition in both child groups, indicating the preservation of low-level visuospatial attentive capabilities. Finally, this study provides evidence that these impairments of executive skills and in inhibitory control, following early brain injuries, manifest in childhood but recover to virtually normal level during adolescence.

PMID: [31780913](#)

32. Impairments, functional limitations, and access to services and education for children with cerebral palsy in Uganda: a population-based study.

Andrews C, Kakooza-Mwesige A, Almeida R, Swartling Peterson S, Wabwire-Mangen F, Eliasson AC, Forssberg H.

Dev Med Child Neurol. 2019 Nov 25. doi: 10.1111/dmcn.14401. [Epub ahead of print]

AIM: To describe the functional limitations and associated impairments of children with cerebral palsy (CP) in rural Uganda, and care-seeking behaviour and access to assistive devices and education. METHOD: Ninety-seven children with CP (42 females, 55 males; age range 2-17y) were identified in a three-stage population-based screening with subsequent medical examinations and functional assessments. Information on school and access to care was collected using questionnaires. The data were compared with Swedish and Australian cohorts of children with CP. We used the χ^2 test and linear regression models to analyse differences between groups. RESULTS: Younger children were more severely impaired than older children. Two-fifths of the children had severe impairments in communication, about half had intellectual disability, and one third had seizures. Of 37 non-walking children, three had wheelchairs and none had walkers. No children had assistive devices for hearing, seeing, or communication. Care-seeking was low relating to lack of knowledge, insufficient finances, and 'lost hope'. One-third of the children attended school. Ugandan children exhibited lower developmental trajectories of mobility and self-care than a Swedish cohort. INTERPRETATION: The needs for children with CP in rural Uganda are not met, illustrated by low care-seeking, low access to assistive devices, and low school attendance. A lack of rehabilitation and stimulation probably contribute to the poor development of mobility and self-care skills. There is a need to develop and enhance locally available and affordable interventions for children with CP in Uganda. WHAT THIS PAPER ADDS: Development of mobility and self-care skills is lower in Ugandan than Swedish children with cerebral palsy (CP). Older children in Uganda with CP are less impaired than younger children. Untreated seizures and impairments of communication and intellect are common. Access to health services, assistive devices, and education is low. Caregivers lack knowledge and finances to seek care and often lose hope of their child improving.

PMID: [31762018](#)

33. Registry-based Research in Cerebral Palsy: The Cerebral Palsy Research Network.

Hurvitz EA, Gross PH, Gannotti ME, Bailes AF, Horn SD.

Phys Med Rehabil Clin N Am. 2020 Feb;31(1):185-194. doi: 10.1016/j.pmr.2019.09.005. Epub 2019 Nov 7.

Registries are a powerful tool for clinical research. Clinical registries for cerebral palsy can aid in comparative effectiveness research, especially using the practice-based evidence model. The Cerebral Palsy Research Network (CPRN) was initiated in 2014 as a patient-centered, multidisciplinary registry. The leadership group initiated a 4-stage participatory action research process: listen, reflect, plan/analyze, and take action. CPRN also joined with CP NOW, an advocacy group, to create a research agenda for cerebral palsy. With more than 20 centers and growing, CPRN hopes to generate evidence for developing best practices and measure their implementation and impact for individuals with cerebral palsy throughout North America.

PMID: [31760991](#)

34. Outcome Assessment and Function in Cerebral Palsy.

Vargus-Adams JN.

Phys Med Rehabil Clin N Am. 2020 Feb;31(1):131-141. doi: 10.1016/j.pmr.2019.09.011. Epub 2019 Nov 8.

Care and research in childhood cerebral palsy (CP) continue to evolve. As our understanding of CP grows more nuanced, so grows our need to describe function, activities, challenges, adaptations of children with CP. In CP, robust means of measuring outcomes are vital to understanding utility of treatments. Research must accurately measure meaningful constructs of children with CP as a reliable ruler to establish if interventions produce useful effects. This article addresses the challenges of outcome measurement in CP, current status of outcome measurement in CP, and issues of understanding change in childhood CP.

PMID: [31760986](#)**35. Comprehensive Care in Cerebral Palsy.**

Schwabe AL.

Phys Med Rehabil Clin N Am. 2020 Feb;31(1):1-13. doi: 10.1016/j.pmr.2019.09.012.

Children with cerebral palsy (CP) will be cared for at some point by all pediatricians and many pediatric subspecialists due to this condition being the most common motor disability of childhood. Comprehensive care of the child with CP requires individuals with specialized training, and these children benefit from an interdisciplinary team approach to care. CP is heterogeneous due to varied causes, which necessitates individualized treatment plans. The CP specialist must be prepared to support the needs of the child with CP holistically and must dialogue regularly with members of the team and involve the family in decision-making.

PMID: [31760983](#)**36. Transition to Adult Care.**

Berens J, Wozow C, Peacock C.

Phys Med Rehabil Clin N Am. 2020 Feb;31(1):159-170. doi: 10.1016/j.pmr.2019.09.004. Epub 2019 Nov 6.

The transition from pediatric-based to adult-based health care is often difficult, especially for individuals with chronic illness or developmental disabilities, such as cerebral palsy. This article describes the current state of health care transition, focusing on some of the elements that contribute to the complexity of this challenging life period, including: changes to health care insurance, medicolegal considerations and options for supported decision making, discussions about vocations and related barriers and resources, and important psychosocial issues faced by many patients with cerebral palsy. Evidence-based processes and practices are described that can help facilitate health care transition planning and improve outcomes.

PMID: [31760989](#)**37. Evaluation of the prognostic factors in school age children who experienced neonatal seizures.**

Pembegul Yıldız E, Tatlı B, Ulak Ozkan M, Erarslan E, Aydın N, Çalışkan M, Özmen M.

Epilepsy Behav. 2019 Nov 23;102:106673. doi: 10.1016/j.yebeh.2019.106673. [Epub ahead of print]

BACKGROUND: This prospective study aimed to evaluate long-term neurodevelopmental outcomes and risk factors of the previously reported cohort, at their school age. **METHOD:** We included neonates whose seizures were directly observed by the child neurologist or neonatologist based on clinical observations. They were assessed for cognitive and neurological outcomes at the age of 9-11 years. The test battery included a neurological examination, the Wechsler Intelligence Scale for Children-Revised (WISC-R) test, and patients with the diagnosis of cerebral palsy (CP) were graded according to the Gross Motor Function Classification System (GMFCS). The primary outcome of this study was to determine risk factors for the long-term prognosis of neonatal seizures. **RESULTS:** For the long-term follow-up, 97 out of 112 patients of the initial cohort were available (86.6%). We found that 40 patients (41%) have the normal prognosis, 22 patients (22.7%) have the diagnosis of CP, and 30 patients (30.9%) were diagnosed as having epilepsy. Twelve out of 22 patients with CP had the diagnosis of epilepsy. The WISC-R full-scale IQ scores were <55 points in 27 patients (27.8%) and were >85 points in 40 patients (41.2%). According to GMFCS, 10 patients were classified as levels 1-2, and 12 patients were classified as levels 3-5. In multivariate

regression analyses, 5-min APGAR score <6 was found to be an independent risk factor for CP, and 5-min APGAR score <6 and neonatal status epilepticus were independent risk factors for epilepsy. **CONCLUSIONS:** This prospective cohort study reveals that abnormal school age outcome after neonatal seizures are significantly related to 5-min APGAR score <6 and neonatal status epilepticus.

PMID: [31770716](#)

38. Is there a role for therapeutic hypothermia administration in term infants with mild neonatal encephalopathy?

Perretta L, Reed R, Ross G, Perlman J.

J Perinatol. 2019 Nov 25. doi: 10.1038/s41372-019-0562-z. [Epub ahead of print]

OBJECTIVE: Identifying term infants presenting with early mild neonatal encephalopathy (NE) as candidates for therapeutic hypothermia (TH) remains unclear. Study objectives were to characterize the neonatal clinical, magnetic resonance imaging (MRI), and longer-term outcome in infants with mild NE treated with TH. **STUDY DESIGN:** Retrospective cohort study of infants admitted with mild or moderate NE treated with TH. Enrollment criteria included a sentinel event, severe acidosis, DR interventions, and low Apgar scores. **RESULTS:** Infants with mild (n = 11) and moderate NE (n = 37) received TH. Mild NE findings included hyperalertness (64%), hypotonia (73%), high level sensory response (91%); 64% progressed to moderate NE. Infants with mild vs. moderate NE had less severe MRI changes (0 vs. 16%) and no cerebral palsy (CP) (0 vs. 13%). **CONCLUSIONS:** Outcomes were favorable with mild NE whereas four infants with moderate NE developed CP. A potential role for TH in this population requires further study.

PMID: [31767982](#)

39. Pediatric Neuromuscular Disorders.

Michel C, Collins C.

Pediatr Clin North Am. 2020 Feb;67(1):45-57. doi: 10.1016/j.pcl.2019.09.002.

Neuromuscular disorders are pathologies that can severely affect the quality of life as well as longevity of patients. The most common disorders include cerebral palsy and myelodysplasia. The orthopedic manifestations of these disorders can be treated operatively or nonoperatively. Both focus on the prolongation of mobility and preservation of ambulatory capacity for patients.

PMID: [31779836](#)

40. The Expanding Role of Genetics in Cerebral Palsy.

Emrick LT, DiCarlo SM.

Phys Med Rehabil Clin N Am. 2020 Feb;31(1):15-24. doi: 10.1016/j.pmr.2019.09.006.

Cerebral palsy is a clinical diagnosis of a nonprogressive developmental disorder of motor impairment. The scope of the diagnosis of cerebral palsy has been broadening significantly in recent years to include patients with genetic disorders. This article helps clinicians to determine which patients would benefit from a thorough genetic/metabolic evaluation and helps to delineate an approach for the work-up, with an emphasis on newer technologies and the evolving fields of fetal medicine and genetics. It provides guidance to providers to assist in clarifying an cause for some patient's symptoms.

PMID: [31760988](#)

41. Tuina Massage Improves Cognitive Functions of Hypoxic-Ischemic Neonatal Rats by Regulating Genome-Wide DNA Hydroxymethylation Levels.

Zhang Y, Gao C, Chen D, Wang C, Chen L, Zhang Y, Li B.

Evid Based Complement Alternat Med. 2019 Oct 23;2019:1282085. doi: 10.1155/2019/1282085. eCollection 2019.

In addition to abnormalities of motor and posture, children with cerebral palsy (CP) often have intellectual disability. As a complementary and alternative traditional Chinese medicine (TCM) therapy, Chinese Tuina massage, also called Tuina in

China, has been widely applied in clinical treatment for CP in China for a long time. However, the molecular basis for this still remains largely unknown. Recently, DNA hydroxymethylation has been shown to be sensitive to environment and plays critical roles in some neurological disorders, whereas the research focusing on the relationship between 5 hmC and Tuina therapy for cerebral palsy is deficient. In our study, we first observed that Tuina improved learning and memory functions of hypoxic-ischemic (HI) rat pups. Meanwhile, 5 hmC level of the temporal lobe cortex in the HI neonatal rat model is decreased significantly compared to that of the rats in control and Tuina groups. Then, we used the hMeDIP-Seq method to explore whether and how DNA hydroxymethylation is involved in Tuina therapy for cerebral palsy. Genomic annotation of DhMRs of HI group's hypo-hydroxymethylation to genes revealed enrichment in multiple neurodevelopmental signaling pathways. Moreover, we found the depletion of 5 hmC modifications in genes associated with neuronal development was accompanied by reduced mRNA levels of these genes. Taken together, our results indicate that Tuina may regulate the expression of neurodevelopment-related genes by changing the status of DNA hydroxymethylation, thereby improving learning and memory functions of cerebral palsy.

PMID: [31772590](#)