1. Effectiveness of Cognitive Orientation to daily Occupational Performance over and above functional hand splints for children with cerebral palsy or brain injury: a randomized controlled trial.
Jackman M, Novak I, Lannin N, Froude E, Miller L, Galea C.

BACKGROUND: Functional hand splinting is a common therapeutic intervention for children with neurological conditions. The aim of this study was to investigate the effectiveness of the Cognitive Orientation to daily Occupational Performance (CO-OP) approach over and above conventional functional hand splinting, and in combination with splinting, for children with cerebral palsy or brain injury. METHODS: A multisite, assessor-blinded, parallel, randomized controlled trial was conducted in Australia. Participants (n = 45) were randomly allocated to one of three groups; (1) splint only (n = 15); (2) CO-OP only (n = 15); (3) CO-OP + splint (n = 15). Inclusion: age 4-15 years; diagnosis of cerebral palsy or brain injury; Manual Ability Classification System I-IV; hand function goals; sufficient language, cognitive and behavioral ability. Primary outcome measures were the Canadian Occupational Performance Measure (COPM) and Goal Attainment Scale (GAS). Treatment duration for all groups was 2 weeks. CO-OP was provided in a group format, 1 h per day for 10 consecutive weekdays, with parents actively involved in the group. Hand splints were wrist cock-up splints that were worn during task practice. Three individual goals were set and all participants were encouraged to complete a daily home program of practicing goals for 1 h. Analyses were conducted on an intention to treat basis. CONCLUSIONS: The COPM showed that all three groups improved from baseline to immediately post -treatment. GAS showed a statistically significant difference immediately post -intervention between the splint only and CO-OP only groups (p = 0.034), and the splint only and CO-OP + splint group (p = 0.047) favoring CO-OP after controlling for baseline. The CO-OP Approach™ appeared to enhance goal achievement over and above a functional hand splint alone. There was no added benefit of using hand splints in conjunction with CO-OP, compared to CO-OP alone. Hand splints were not well tolerated in this population. Practice of functional goals, through CO-OP or practice at home, leads to goal achievement for children with cerebral palsy or brain injury. TRIAL REGISTRATION: Registered with the Australian New Zealand Clinical Trials Registry (ACTRN12613000690752) on 24/06/2013.

PMID: 30064403

2. Combining constraint-induced movement therapy and action-observation training in children with unilateral cerebral palsy: a randomized controlled trial.

BACKGROUND: Upper limb (UL) deficits in children with unilateral cerebral palsy (uCP) have traditionally been targeted with motor execution treatment models, such as modified Constraint-Induced Movement Therapy (mCIMT). However, new approaches based on a neurophysiological model such as Action-Observation Training (AOT) may provide new opportunities for enhanced motor learning. The aim of this study is to describe a randomised controlled trial (RCT) protocol investigating the effects of an intensive treatment model, combining mCIMT and AOT compared to mCIMT alone on UL function in children with uCP. Additionally, the role of neurological factors as potential biomarkers of treatment response will be analysed. METHODS: An evaluator-blinded RCT will be conducted in 42 children aged between 6 and 12 years. Before randomization, children will be stratified according to their House Functional Classification Scale, age and type of
3. Do Kinesio-tape change upper extremity position, functional status and family satisfaction of children with Unilateral Cerebral Palsy in short term?

Seyhan K, Çankaya Ö, Tunçdemir M, Üneş S, Günel MK.


The aim of this study was to investigate if Kinesio-tape (KT) changed upper extremity position, functional status and family satisfaction of children with Unilateral Cerebral Palsy (CP) in short term. KT was used on affected upper extremities of 14 children with hemiplegic CP. Zancolli Classification, Manual Ability Classification System (MACS), Upper Limb Rating Scale (ULRS), Quality of Upper extremity skills test (QUEST), Box and Block Test (BBT) were applied for functional status before and after three days. Family satisfaction was assessed with ten-point numeric scale. There were significant differences in Zancolli Classification (p = 0.01), UPRS (p = 0.037) and QUEST dissociated movement sub-dimension (p=0.002) and family satisfaction (p = 0.001) after the KT application but there was no significant difference about performance. KT is a promising additional approach to increase upper extremity status and families were satisfied the images of upper extremity with KT.

PMID: 30064880

4. Discovering the sense of touch: protocol for a randomised controlled trial examining the efficacy of a somatosensory discrimination intervention for children with hemiplegic cerebral palsy.


BACKGROUND: Of children with hemiplegic cerebral palsy, 75% have impaired somatosensory function, which contributes to learned non-use of the affected upper limb. Currently, motor learning approaches are used to improve upper-limb motor skills in these children, but few studies have examined the effect of any intervention to ameliorate somatosensory impairments. Recently, Sense© training was piloted with a paediatric sample, seven children with hemiplegic cerebral palsy, demonstrating statistically and clinically significant change in limb position sense, goal performance and bimanual hand-use. This paper describes a protocol for a Randomised Controlled Trial of Sense© for Kids training, hypothesising that its receipt will improve somatosensory discrimination ability more than placebo (dose-matched Goal Directed Therapy via Home Program). Secondary hypotheses include that it will alter brain activation in somatosensory processing regions, white-matter characteristics of the thalamocortical tracts and improve bimanual function, activity and participation more than Goal Directed Training via Home Program. METHODS AND DESIGN: This is a single blind, randomised matched-pair, placebo-controlled trial. Participants will be aged 6-15 years with a confirmed description of hemiplegic cerebral palsy and somatosensory discrimination impairment, as measured by the sense© assess Kids. Participants will be randomly allocated to receive 3h a week for 6 weeks of either Sense© for Kids or Goal Directed Therapy via Home Program. Children will be matched on age and severity of somatosensory discrimination impairment. The primary outcome will be somatosensory discrimination ability, measured by sense© assess Kids score. Secondary outcomes will include degree of brain activation in response to a somatosensory task measured by functional MRI, changes in the white matter of the thalamocortical tract measured by diffusion MRI, bimanual motor function, activity and participation. DISCUSSION: This study will assess the efficacy of an intervention to increase somatosensory discrimination ability in children with cerebral palsy. It will explore clinically important questions about the efficacy of intervening in somatosensory impairment to improve bimanual motor function, compared with focusing on motor impairment directly, and whether focusing on motor impairment alone can affect somatosensory ability. TRIAL REGISTRATION: This trial is registered with the Australian New Zealand Clinical Trials Registry, registration number: ACTRN1261800348257. World Health Organisation universal trial number: U1111-1210-1726.

PMID: 30064388
5. Brain-controlled modulation of spinal circuits improves recovery from spinal cord injury.


The delivery of brain-controlled neuromodulation therapies during motor rehabilitation may augment recovery from neurological disorders. To test this hypothesis, we conceived a brain-controlled neuromodulation therapy that combines the technical and practical features necessary to be deployed daily during gait rehabilitation. Rats received a severe spinal cord contusion that led to leg paralysis. We engineered a proportional brain-spine interface whereby cortical ensemble activity constantly determines the amplitude of spinal cord stimulation protocols promoting leg flexion during swing. After minimal calibration time and without prior training, this neural bypass enables paralyzed rats to walk overground and adjust foot clearance in order to climb a staircase. Compared to continuous spinal cord stimulation, brain-controlled stimulation accelerates and enhances the long-term recovery of locomotion. These results demonstrate the relevance of brain-controlled neuromodulation therapies to augment recovery from motor disorders, establishing important proofs-of-concept that warrant clinical studies.

PMID: 30068906

Bakaniene I, Urbanaviciene G, Janaviciute K, Prasauskiene A.


AIM OF THE STUDY: To investigate the effect of the Inerventions method on gross motor function in children with spastic cerebral palsy (CP). CLINICAL RATIONALE FOR THE STUDY: The Inerventions method is the type of transcutaneous electrical nerve stimulation (TENS) delivered through a full-body garment (Mollii suit) that aims to prompt reciprocal inhibition via the antagonist to reduce spasticity in selected muscle groups. Although Mollii is approved by the European Union as a medical device, independent clinical tests have not yet been performed. MATERIALS AND METHODS: 16 children with spastic CP, aged 4.7 ± 1.3 were recruited and then willingly assigned to the Inerventions method (n = 8) and control groups (n = 8). In the Inerventions method group, TENS was applied 1 h per session, 3 days weekly for 3 weeks. Children of the control group received functional exercises program for the same duration, frequency and length. Outcome measures included the Gross Motor Function Measure, passive range of motion (PROM), the Modified Tardieu Scale, and the Timed Up and Go test. RESULTS: While both groups experienced improvements in gross motor function and mobility, the difference in improvement between children treated with the TENS and physiotherapy did not reach statistical significance. No change occurred in PROM and spasticity in either group following the interventions. CONCLUSIONS: There is no superior efficacy of the Inerventions method compared to conventional physiotherapy.

PMID: 30061001

7. The Spastic Hip in Children and Adolescents.
Dohin B.


The hip is the joint most exposed to orthopaedic complications in cerebral palsy (CP) which is the main cause of spasticity in paediatric patients. The initial immaturity of the hip allows the forces applied by the spastic and retracted muscles to displace the femoral head, eventually causing it to dislocate. The risk of hip dislocation increases with the severity and extent of CP, exceeding 70% in the most severe cases. Hip dislocation causes pain in up to 30% of cases, carries a risk of orthopaedic and cutaneous complications, and hinders patient installation and nursing care. These adverse outcomes warrant routine screening, which has been proven effective in lessening the frequency and severity of hip displacement. Preventive techniques including physical therapy, orthoses, and treatments to alleviate spasticity are strongly recommended in every case. The beneficial effects of treating spasticity, if needed via neurosurgical procedures, have been convincingly established. Orthopaedic surgery is required when prevention fails. Soft-tissue release is designed to correct the asymmetry in the forces applied by the muscles. Femoral osteotomy creates the possibility for spontaneous correction of secondary acetabular dysplasia. Progress has been made in standardising the use of multilevel surgery involving the soft tissues, femur, and pelvis, which is often effective in correcting the morphological abnormalities and stabilising the joint. When hip pain or alterations are severe, hip resection or total hip arthroplasty are highly effective in alleviating the pain and improving patient comfort. The spastic hip is a complex condition in which currently available screening protocols and treatment strategies have been proven effective in benefitting patient outcomes.

PMID: 30056240

8. Trunk endurance and gait changes after core stability training in children with hemiplegic cerebral palsy: A randomized controlled trial.
El Shemy SA.

BACKGROUND: Weakness of trunk muscles is a common disorder in children with cerebral palsy (CP). They encounter decreased levels of endurance that can lead to diminished capacity of movement. OBJECTIVE: To evaluate the effect of core stability training on the endurance of trunk muscles and gait parameters in children with hemiplegic CP. METHODS: Thirty children with hemiplegic CP aged 10 to 12 years were randomly assigned to two groups of equal number; control group (A) and study group (B). Both groups underwent the same designed physical therapy program. Moreover, group B underwent core stability training 3 times/week for 8 weeks. Endurance time of trunk muscles and gait parameters were measured before and after the intervention using the trunk endurance tests and the Biodex gait trainer respectively. RESULTS: Both groups showed pre- and post-test statistically significant improvements in the endurance time of trunk flexors and extensors and gait parameters but only group B showed significant improvement in the endurance time of lateral trunk muscles. There were post-treatment statistically significant differences between both groups in favor of group B regarding all measured variables. CONCLUSION: Addition of core stability exercises to the treatment program can effectively improve the endurance time of trunk muscles and gait in children with hemiplegic CP.

PMID: 30056415


BACKGROUND: Botulinum toxin (BTX) injection alone is not sufficient to treat spasticity in children, notably those with cerebral palsy; thus, there is an emerging trend for adjunct therapies to offer greater outcomes than BTX alone. OBJECTIVE: The aim of this systematic review was to evaluate the general effectiveness of adjunct therapies regardless of their nature in children with spasticity. METHODS: MEDLINE, Cochrane and Embase databases were searched from January 1980 to March 15, 2018 for reports of parallel-group trials (randomized controlled trials [RCTs] and non-RCTs) assessing adjunct therapies after BTX injection for treating spasticity in children. Two independent reviewers extracted data and assessed the risk of bias by using the PEDro scale for RCTs and Downs and Black scale (D&B) for non-RCTs. RESULTS: Overall, 20 articles involving 662 participants met the inclusion criteria. The average quality was good for the 16 RCTs (mean PEDro score 7.4 [SD 1.6]) and poor to moderate for the 4 non-RCTs (D&B score 9 to 17). Adjunct therapies consisted of casting/posture, electrical stimulation, resistance training and rehabilitation programmes. Casting associated with BTX injection improved the range of passive and active motion and reduced spasticity better than did BTX alone (9 studies), with a follow-up of 1 year. Resistance training enhanced the quality and performance of muscles without increasing spasticity. Only 3 rehabilitation programmes were studied, with encouraging results for activities. CONCLUSION: Lower-limb posture with casting in children has a high level of evidence, but the long-term efficacy of short-leg casting needs to be evaluated. A comparison between the different modalities of casting is missing, and studies specifically devoted to testing the different kinds of casting are needed. Moreover, the delay to casting after BTX injection is not clear. Data on electrical stimulation are not conclusive. Despite the small number of studies, resistance training could be an interesting adjunct therapy notably to avoid loss of strength after BTX injection. Rehabilitation programmes after BTX injection still need to be evaluated.

PMID: 30063979

10. Effectiveness of multiple botulinum toxin sessions and the duration of effects in spasticity therapy in children with cerebral palsy.
Mirska A, Kulak W, Okurowska-Zawada B, Dmitruk E.

PURPOSE: The aim of this study was to assess the effectiveness of long-term therapy with multiply botulinum neurotoxin (BoNT) injections. METHODS: In 2004-2010, 60 children with spastic cerebral palsy aged 2-16 were treated multiple botulinum toxin sessions (injections in gastrocnemius muscle and soleus muscles). In each patient, we rated muscle tone by Modified Ashworth Scale, passive range of motion in ankle joint with extended, and flexed knee joint and gait using the Physician Rating Scale. Assessment was done before and after injection, up to eight BoNT sessions. RESULTS: The generalized additive models showed that a single treatment effect was visible for 3 months. The number of injections did not impact the effectiveness. Improvement in muscle tone was greater in children with hemiplegia than diplegia ($\beta = -0.294; p = 0.014$). Improvement in range of motion with extended knee joint was greater in hemiplegic than diplegic types ($\beta = 0.414; p = 0.002$), and improvement in range of motion with flexed knee was greater in children with more severe impairment (Gross Motor Function Classification System III vs. I, $\beta = 0.0603; p = 0.025$; V vs. I, $\beta = 0.691; p = 0.023$). The gait improvement rate decreased with patient age ($p = 0.007$). CONCLUSIONS: BoNT therapy is effective regardless of the number of injection sessions and duration of treatment. However, it is affected by the patient's age, type of cerebral palsy, and degree of impairment.

PMID: 30058050
11. The influence of maximum isometric muscle force scaling on estimated muscle forces from musculoskeletal models of children with cerebral palsy.

BACKGROUND: Musculoskeletal models do not include patient-specific muscle forces but rely on a scaled generic model, with muscle forces left unscaled in most cases. However, to use musculoskeletal simulations to inform clinical decision-making in children with cerebral palsy (CP), inclusion of subject-specific muscle forces is of utmost importance in order to represent each child's compensation mechanisms introduced through muscle weakness. RESEARCH AIM: The aims of this study were to (i) evaluate if maximum isometric muscle forces (MIMF) in musculoskeletal models of children with CP can be scaled based on strength measurements obtained with a hand-held-dynamometer (HHD), (ii) evaluate the impact of the HHD based scaling approach and previously published MIMF scaling methods on computed muscle forces during gait, and (iii) compare maximum muscle forces during gait between CP and typically developing (TD) children. METHODS: Strength and motion capture data of six CP and motion capture data of six TD children were collected. The HHD measurements to obtain hip, knee and ankle muscle strength were simulated in OpenSim and used to modify MIMF of the 2392-OpenSim model. These muscle forces were compared to the MIMF scaled on the child's body mass and a scaling approach, which included the body mass and muscle-tendon lengths. OpenSim was used to calculate peak muscle forces during gait. RESULTS: Ankle muscle strength was insufficient to reproduce joint moments during walking when MIMF were scaled based on HHD. During gait, peak hip and knee extensor muscle forces were higher and peak ankle dorsi-flexor forces were lower in CP compared to TD participants. SIGNIFICANCE: HHD measurements can be used to scale MIMF for the hip and knee muscle groups but underestimate the force capacity of the ankle muscle groups during walking. Muscle-tendon-length and mass based scaling methods affected muscle activations but had little influence on peak muscle forces during gait.

PMID: 30075411

12. Synergy complexity during maximal voluntary isometric contractions.
Goudriaan M, Shuman BR, Steele KM, Molenaers G, Goemans N, Desloovere K.

PMID: 30071478

13. Lower limb muscle volume estimation from maximum cross-sectional area and muscle length in cerebral palsy and typically developing individuals.
Vanmechelen I, Shortland A, Noble J.

BACKGROUND: Deficits in muscle volume may be a significant contributor to physical disability in young people with cerebral palsy. However, 3D measurements of muscle volume using MRI or 3D ultrasound may be difficult to make routinely in the clinic. We wished to establish whether accurate estimates of muscle volume could be made from a combination of anatomical cross-sectional area and length measurements in samples of typically developing young people and young people with bilateral cerebral palsy. METHODS: Lower limb MRI scans were obtained from the lower limbs of 21 individuals with cerebral palsy(14.7 ± 3 years, 17 male) and 23 typically developing individuals (16.8 ± 3.3 years, 16 male). The volume, length and anatomical cross-sectional area were estimated from six muscles of the left lower limb. FINDINGS: Analysis of Covariance demonstrated that the relationship between the length*cross-sectional area and volume was not significantly different depending on the subject group. Linear regression analysis demonstrated that the product of anatomical cross-sectional area and length bore a strong and significant relationship to the measured muscle volume (R2 values between 0.955 and 0.988) with low standard error of the estimates of 4.8 to 8.9%. INTERPRETATION: This study demonstrates that muscle volume may be estimated accurately in typically developing individuals and individuals with cerebral palsy by a combination of anatomical cross-sectional area and muscle length. 2D ultrasound may be a convenient method of making these measurements routinely in the clinic.

PMID: 30055932

14. There are common patterns of muscle synergy in cerebral palsy crouch gait.

BACKGROUND: Muscle synergy is the leading hypothesis on how the central nervous system coordinates limb functions. Cerebral palsy (CP) patients utilize fewer synergies, and are believed to have a simpler neuromuscular control. This study was undertaken to determine whether consistent muscle synergies are recruited during ambulation in cerebral palsy crouch gait and
how the muscles contribute to such synergies. METHODS: Ten ambulatory CP patients were recruited. All walked with crouch gait. sEMG data were collected from 14 lower limb muscles during gait analysis. Non-negative matrix factorization method was utilized to extract muscle synergies. RESULTS AND SIGNIFICANCE: A total of five synergy patterns were extracted. One synergy was shared among all patients, and was more active during swing. Another pattern was observed in seven patients, and was active during stance. These data suggest that CP patients with crouch gait utilize the simplest neuromuscular pattern to ambulate. One synergy is responsible for the swing phase, and one for the stance. This will substantially limit the adaptability of gait to various walking circumstances. The results of this study may help guide gait training programs and maximize the efficiency of ambulation in CP crouch gait.

PMID: 30055928

15. Effect of planovalgus foot deformity on the vertical displacement of center of mass in children with bilateral spastic cerebral palsy.
Ahmed M, Waly E.
PMID: 30055931

Berge MA, Brandvik SM, Roeleveld K, Goihl T.
PMID: 30055929

17. Effects of backward-downhill treadmill training versus manual static plantarflexor stretching on muscle-joint pathology and function in children with spastic Cerebral Palsy.
Hösl M, Böhm H, Eck J, Döderlein L, Arampatzis A.

BACKGROUND: Patients with spastic Cerebral Palsy are prone to equinus deformities, likely affected by short and inextensible plantarflexor muscles. Manual stretching is a popular treatment but its effectiveness concerning joint mobility, muscle-tendon morphometrics and walking function is debated. Eccentric exercise by backward-downhill treadmill training could be a therapeutic alternative for ambulatory patients improving gait and muscle function. RESEARCH QUESTION: What are the effects of eccentric training by backward-downhill treadmill training and plantarflexor stretching concerning gait and muscle function in patients with spastic Cerebral Palsy? METHODS: 10 independent ambulators with spastic Cerebral Palsy (12 [SD 4] years old, 2 uni- and 8 bilaterally affected) participated in a randomized crossover-study. One group started with manual static stretching, the other one with backward-downhill treadmill training. Each treatment period lasted 9 weeks (3 sessions per week). Pre and post treatments, 3D gait was assessed during comfortable and during fastest possible walking. Ultrasonography and dynamometry were used to test plantarflexor strength, passive joint flexibility, as well as gastrocnemius morphometrics, stiffness and strain on muscle-tendon and joint level. RESULTS: When comparing both treatments, backward-downhill treadmill training lead to larger single stance dorsiflexion at comfortable walking speed (+2.9°, P = 0.041) and faster maximally achievable walking velocities (+0.10 m/s, P = 0.017). Stretching reduced knee flexion in swing, particularly at faster walking velocities (-5.4°, P = 0.003). Strength, ankle joint flexibility, as well as stiffness on muscle-tendon and joint level were not altered, despite similar increases in passive muscle and fascicle strain with both treatments (P ≤ 0.023).
SIGNIFICANCE: Backward-downhill treadmill training can be an effective gait treatment, probably improving coordination or reducing dynamic stretch sensitivity. More intense BDTT might be necessary to further alter muscle-tendon properties. Manual static plantarflexor stretching may not be optimal in Cerebral Palsy patients with high ambulatory status.

PMID: 30055388

Salami F, Krautwurst BK, Leboucher J, Wolf SI.

Assessment of angular momentum and harmonic ratio for children with cerebral palsy during walking.
Cherni Y, Ballaz L, Girarin-Vignola G, Begon M.
PMID: 30061019

20. A robot-based gait training therapy for pediatric population with cerebral palsy: goal setting, proposal and preliminary clinical implementation.
Bayón C, Martín-Lorenzo T, Moral-Saiz B, Ramírez Ó, Pérez-Somarriba Á, Lerma-Lara S, Martinez I, Rocon E.
BACKGROUND: The use of robotic trainers has increased with the aim of improving gait function in patients with limitations. Nevertheless, there is an absence of studies that deeply describe detailed guidelines of how to correctly implement robot-based treatments for gait rehabilitation. This contribution proposes an accurate robot-based training program for gait rehabilitation of pediatric population with Cerebral Palsy (CP). METHODS: The program is focused on the achievement of some specifications defined by the International Classification of Functioning, Disability and Health framework, Children and Youth version (ICF-CY). It is framed on 16 non-consecutive sessions where motor control, strength and power exercises of lower limbs are performed in parallel with a postural control strategy. A clinical evaluation with four pediatric patients with CP using the CPWalker robotic platform is presented. RESULTS: The preliminary evaluation with patients with CP shows improvements in several aspects as strength (74.03 ± 40.20%), mean velocity (21.46 ± 33.79%), step length (17.95 ± 20.45%) or gait performance (e.g. 66 ± 63.54% in Gross Motor Function Measure-88 items, E and D dimensions). CONCLUSIONS: The improvements achieved in the short term show the importance of working strength and power functions meanwhile over-ground training with postural control. This research could serve as preliminary support for future clinical implementations in any robotic device. TRIAL REGISTRATION: The study was carried out with the number R-0032/12 from Local Ethical Committee of the Hospital Infantil Niño Jesús. Public trial registered on March 23, 2017: ISRCTN18254257.
PMID: 30053857

Böhm H, Wanner P, Rethwilm R, Döderlein L.
BACKGROUND: Running is a fundamental movement skill and a prerequisite for children to participate in numerous daily activities. The prevalence of the ability to run in people with Cerebral Palsy and the role of their impairments on running ability are unknown. Therefore, the aim of this study is to determine the prevalence of the ability to run and to identify contributing factors. METHODS: In this study, 280 children and adolescents with spastic Cerebral Palsy, Gross Motor Function Classification System level II were included. The ability to run was defined by instrumented running analysis. Runners and non-runners were compared regarding their clinical measures of spasticity, weakness, and postural control. Logistic regression was applied to identify the most important predictors for the ability to run. FINDINGS: The ability to run was significantly higher in unilateral (67%) than in bilateral (55%) affected patients. Significant differences between runners and non-runners were found for spasticity, BMI and postural control, but not for muscle strength. Lower M. rectus femoris spasticity, higher m gastrocnemius spasticity and enhanced postural control appear to be the best predictors for being able to run. INTERPRETATION: Patients with Gross Motor Function Classification System level II represent a large group in the gait laboratory and the functional impairment within this group differs greatly. Therefore, for clinical decision making we suggest to separate patients in this group based on their running ability. Spasticity and postural control affect the ability to run and needs to be accounted for in intervention programs.
PMID: 30071441

22. Energy expenditure is associated with age, anthropometric indicators and body composition in children with spastic cerebral palsy [Spanish].
INTRODUCTION: proper estimation of energy requirements in children with cerebral palsy (CP) is essential in ensuring that their energy needs are optimally met. OBJECTIVE: therefore, the purpose of this study was to demonstrate that resting energy
25. A study of the dental treatment needs of special patients: cerebral paralysis and Down syndrome.
Rodriguez Peinado N, Mourelle Martinez MR, Diéguez Pérez M, De Nova García MJ.
AIM: The aim of the present study was to compare the dental characteristics and the oral health care needs of patients with Cerebral Paralysis (CP) and Down Syndrome (DS). MATERIALS AND METHODS: The selected sample consisted of 28 patients of both sexes between 10 and 20 years of age. STUDY DESIGN: observational, descriptive and cross-sectional study. STATISTICS: The statistical analysis was carried out with the SPSS 19.0 program for Windows. The frequency distribution and contingency tables were analysed, as was interobserver concordance. RESULTS: Fifty percent of the patients with CP presented dental traumas, compared to 15% of the patients with DS. Dental prophylaxis was the most prevalent treatment in both groups (77% in CP compared to 86.7% in DS). The most frequent habit was oral breathing, which was found in 69.2% of the patients with CP and 80% of those with DS. CONCLUSIONS: Patients with CP and DS require early dental care in order to prevent and limit the severity of the pathologies observed.

PMID: 30063157

26. Validation of a drooling questionnaire in Indian children with cerebral palsy.
Job A, Naina P, Syed KA, Thomas M, John M, Varghese AM.

BACKGROUND: Drooling of saliva is a common problem in children with cerebral palsy. In addition to causing impairment in articulation, drooling also affects socialization, interpersonal relationships and integration into society for these children. There are various methods to assess drooling which measure directly the amount of saliva drooled. However the most convenient and popular method is the use of questionnaires which are mostly western based and need slight modification for the Indian scenario Aim—Validation of a modified questionnaire for the assessment of drooling in children with cerebral palsy.

METHOD: The modified questionnaire was administered to parents of children with cerebral palsy willing to participate in the study. The drooling score was compared with objective tests, namely cotton pad test and drooling quotient. Internal consistency was assessed using the Cronbach's alpha, test retest reliability by Intraclass Correlation and sensitivity analysis by the Receiver operating characteristic curve.

RESULTS: The modified questionnaire was found to be easy to administer. The Cronbach's alpha coefficient was between 0.867 and 0.879 which implies a high degree on internal consistency. The intraclass correlation and the test retest reliability was found to be statistically significant with a p value < 0.001 which show that the questionnaire was highly reliable for repeat administration as well as administration by different investigators. The ROC Area was found to be 0.94 with a standard error of 0.02 with a 95% confidence interval of 0.88-0.99, which suggests that the score has great specificity, closer agreement between specificity and sensitivity and excellent precision.

CONCLUSION: Our modified questionnaire was easy to administer, highly reliable and valid with high internal consistency. A score of 24 on the questionnaire was found to be the most sensitive and specific point to discriminate between the mild and severe droolers in children with cerebral palsy.

PMID: 30055740

Salavati M, Vameghi R, Hosseini SA, Saeedi A, Gharib M.

INTRODUCTION: The present study aimed to investigate validity and reliability of Persian Dimensions of Mastery Questionnaire (DMQ18) in children with cerebral palsy. MATERIAL AND METHODS: The original version was carried out through back translation into Persian, and then the construct validity was assessed by confirmatory factor analysis; and reliability was evaluated through Cronbach's alpha (n=230). Intra-class correlation coefficient (ICC) was used for test retest reliability (n=32). RESULTS: 230 parents (155 (67.4%) mothers and 75 (32.6%) fathers) of children and adolescents with CP with an average age of 126.99±24.59 months participated in the present research. Non-questions excluded from the confirmatory factor analysis, and thus all questions remained. Internal consistency reliability and total score were acceptable in all domains (higher than 0.70) except for negative reactions, sadness/shame (Cronbach's alpha of 0.414). Intra-class correlation coefficient of all domains and total score were significant (p<0.001). CONCLUSION: DMQ18 (parental report) was valid and reliable for children with cerebral palsy. It also provided valuable information about different aspects of motivation in CP children according to their parents' opinion, and thus it can be used in clinical interventions.

PMID: 30061799


31. A flexible omnibus matching algorithm (FOMA) to support treatment decisions for children with cerebral palsy.

Schwartz MH.


Edwards TA, Theologis T, Wright J.


AIM: To review the potential predictors of outcome after single-event multilevel surgery (SEMLS) in children with cerebral palsy (CP). METHOD: A literature search using the following criteria was performed in six electronic databases: (1) children with cerebral palsy; (2) analysed potential predictors of outcome after SEMLS; (3) minimum 12 months follow-up. The potential predictors were predefined: sex; topographical distribution; socio-economic status; Gross Motor Function Classification System (GMFCS) level; preoperative kinematic summary statistic; age at surgery. Study quality was appraised with the methodological index for non-randomized studies (MINORS) and the Oxford Centre for Evidence-Based Medicine scale. RESULTS: Of the seven studies identified, the MINORS scores ranged from 9 to 11 and all were graded 2b on the Oxford Centre for Evidence-Based Medicine scale. There was little or no evidence to support sex, topographical distribution, or socio-economic status as predictive factors after SEMLS. Preoperative Gait Profile Score (GPS) was the best measure of expected improvement in gait kinematics. Parent-reported satisfaction and GPS were best after SEMLS in children graded GMFCS II. The best long-term results were seen in those aged between 10 years and 12 years of age. INTERPRETATION: The candidate who might expect to realize the most improvement from SEMLS is aged between 10 years and 12 years, is in GMFCS level II, and has a poor preoperative GPS. WHAT THIS PAPER ADDS: Children aged 10 to 12 years, in Gross Motor Function Classification System level II, with a poor preoperative Gait Profile Score might expect to realize the most improvement after single-event multilevel surgery.

PMID: 30073470


Chiang KL, Kuo FC, Cheng CY, Chang KP.


INTRODUCTION: The nationwide prevalence of cerebral palsy (CP) is unknown due to the lack of a population-based registration system for CP in Taiwan. This study was the largest nationwide, population-based, cross-sectional study to estimate the prevalence of CP, prevalence rates of comorbid epilepsy in patients with CP, and association with socioeconomic status (SES) in Taiwan. The crude prevalence rate and age- and gender-specific prevalence rates were estimated. METHODS: A total of 8419 patients with CP were enrolled, and the estimated prevalence of CP was 1.76% in the pediatric population and 1.51% and 1.98% in girls and boys, respectively. The prevalence rate of epilepsy in patients with CP was 29.8%. RESULTS: The result revealed a higher prevalence of CP and epileptic CP in members of families with lower insurance premiums than those with higher insurance premiums and those from East Taiwan compared with those from other areas of Taiwan. Moreover, a higher prevalence of CP is shown in rural area than urban area. DISCUSSION: SES and geographic variables were significantly associated with the risk of epilepsy in children with CP. Patients with epileptic CP had a higher odds ratio of several neuropsychiatric diseases, including mental retardation, ophthalmologic problems, hearing impairment, and hydrocephalus.

PMID: 30074083
Treatment outcomes among children with cerebral palsy are mediocre, unpredictable, and stagnant over several decades. We use a nearest-neighbors matching algorithm to predict outcomes from individuals. The algorithm allows clinician input regarding the relevant matching parameters, treatment of choice, and outcome of interest. The algorithm was tested on 1092 limbs that underwent single-event multi-level surgery. Predictions compared favorably to previous regression-based approaches, producing smaller root mean squared errors across the spectrum of kinematics.

PMID: 30064886

32. Effect of hypothermia on interleukin-1 receptor antagonist pharmacodynamics in inflammatory-sensitized hypoxic-ischemic encephalopathy of term newborns.
Chevin M, Guraut C, Sébire G.

BACKGROUND: Hypothermia is increasingly tested in several neurological conditions, such as neonatal encephalopathy, stroke, traumatic brain injury, subarachnoid hemorrhage, spinal cord injury, and neurological outcomes of cardiac arrest. Current studies aim to increase benefits of hypothermia with new add-on therapies including immunomodulatory agents. Hypothermia has been shown to affect the metabolism of commonly used drugs, including those acting on neuroimmune pathways. OBJECTIVE: This study focuses on the effect of hypothermia on interleukin-1 receptor antagonist pharmacodynamics in a model of neonatal encephalopathy. METHODS: The effect of hypothermia on (i) the tissue concentration of the interleukin-1 receptor antagonist, (ii) the interleukin-1 inflammatory cascade, and (iii) the neuroprotective potential of interleukin-1 receptor antagonist has been assessed on our rat model of neonatal encephalopathy resulting from inflammation induced by bacterial compound plus hypoxia-ischemia. RESULTS: Hypothermia reduced the surface of core and penumbra lesions, as well as alleviated the brain weight loss induced by LPS+HI exposure. Hypothermia compared to normothermia significantly increased (range 50-65%) the concentration of the interleukin-1 receptor antagonist within the central nervous system. Despite this increase of intracerebral interleukin-1 receptor antagonist concentration, the intracerebral interleukin-1-induced tumor necrosis factor-alpha cascade was upregulated. In hypothermic condition, the known neuroprotective effect of interleukin-1 receptor antagonist was neutralized (50 mg/kg/12 h for 72 h) or even reversed (200 mg/kg/12 h for 72 h) as compared to normothermic condition. CONCLUSION: Hypothermia interferes with the pharmacodynamic parameters of the interleukin-1 receptor antagonist, through a bioaccumulation of the drug within the central nervous system and a paradoxical upregulation of the interleukin-1 pathway. These effects seem to be at the origin of the loss of efficiency or even toxicity of the interleukin-1 receptor antagonist when combined with hypothermia. Such bioaccumulation could happen similarly with the use of other drugs combined to hypothermia in a clinical context.

PMID: 30067042

33. Twin-to-twin transfusion syndrome neurodevelopmental follow-up study (neurodevelopmental outcomes for children whose twin-to-twin transfusion syndrome was treated with placental laser photoa coagulation).

BACKGROUND: Twin-to-twin transfusion syndrome (TTTS) is a serious complication of 10-15% of twin or triplet pregnancies in which multiple fetuses share a single placenta. Communicating placental vessels allow one fetus (the donor) to pump blood to the other (the recipient). Mortality rates without intervention are high, approaching 100% in some series, with fetal deaths usually due to cardiac failure. Surgical correction using laser photoa coagulation of communicating placental vessels was developed in the 1980s and refined in the 1990s. Since it was introduced in Victoria in 2006, laser surgery has been performed in approximately 120 pregnancies. Survival of one or more fetuses following laser surgery is currently > 90%, however the neurodevelopmental outcomes for survivors remain incompletely understood. Prior to laser therapy, at least one in five survivors of TTTS had serious adverse neurodevelopmental outcomes (usually cerebral palsy). Current estimates of neurological impairment among survivors following laser surgery vary from 4 to 31% and long-term follow-up data are limited. METHODS: This paper describes the methodology for a retrospective cohort study in which children aged 24 months and over (corrected for prematurity), who were treated with laser placental photoa coagulation for TTTS at Monash Health in Victoria, Australia, will undergo comprehensive neurodevelopmental assessment by a multidisciplinary team. Evaluation will include parental completion of pre-assessment questionnaires of social and behavioural development, a standardised medical assessment by a developmental paediatrician or paediatric neurologist, and age-appropriate cognitive and academic, speech and fine and gross motor assessments by psychologists, speech and occupational therapists or physiotherapists. Assessments will be undertaken at the Murdoch Children's Research Institute/Royal Children's Hospital, at Monash Health or at another mutually agreed location. Results will be recorded in a secure online database which will facilitate future related research.

DISCUSSION: This will be the first study to report and evaluate neurodevelopmental outcomes following laser surgery for twin-to-twin transfusion syndrome in Victoria, and will inform clinical practice regarding follow-up of children at risk of adverse outcomes.

PMID: 30068295

34. Neurodevelopment After Perinatal Arterial Ischemic Stroke.
Wagenaar N, Martinez-Biarge M, van der Aa NE, van Haastert IC, Groenendaal F, Benders MJNL, Cowan FM, de Vries LS.

BACKGROUND AND OBJECTIVES: Perinatal arterial ischemic stroke (PAIS) leads to cerebral palsy in ~30% of affected children and has other neurologic sequelae. Authors of most outcome studies focus on middle cerebral artery (MCA) stroke without differentiating between site and extent of affected tissue. Our aim with this study was to report outcomes after different PAIS subtypes. METHODS: Between 1990 and 2015, 188 term infants from 2 centers (London [n = 79] and Utrecht [n = 109]) had PAIS on their neonatal MRI. Scans were reevaluated to classify stroke territory and determine specific tissue involvement. At 18 to 93 (median 41.7) months, adverse neurodevelopmental outcomes were recorded as 1 or more of cerebral palsy, cognitive deficit, language delay, epilepsy, behavioral problems, or visual field defect. RESULTS: The MCA territory was most often involved (90%), with posterior or anterior cerebral artery territory strokes occurring in 9% and 1%, respectively. Three infants died, and 24 had scans unavailable for reevaluation or were lost to follow-up. Of 161 infants seen, 54% had an adverse outcome. Outcomes were the same between centers. Main branch MCA stroke resulted in 100% adverse outcome, whereas other stroke subtypes had adverse outcomes in only 29% to 57%. The most important outcome predictors were involvement of the corticospinal tracts and basal ganglia. CONCLUSIONS: Although neurodevelopmental outcome was adverse in at least 1 domain with main branch MCA stroke, in other PAIS subtypes outcome was favorable in 43% to 71% of children. Site and tissue involvement is most important in determining the outcome in PAIS.

PMID: 30072575

35. Functional recovery after the systemic administration of mesenchymal stem cells in a rat model of neonatal hypoxic-ischemia.

OBJECTIVE Children who have experienced neonatal hypoxic-ischemic encephalopathy often develop cerebral palsy. Although many treatments have been performed, few effective therapies are available. In this study, the authors tested in rats with hypoxia-ischemia (HI) injuries the hypothesis that the systemic infusion of mesenchymal stem cells (MSCs) would result in functional improvement by facilitating neural compensation in the contralateral cortex. METHODS Postnatal day (P) 7 (P7) rats that had undergone unilateral hemisphere hypoxia-ischemia (modified Rice-Vannucci model) were randomly assigned to MSC-infused or vehicle-infused groups. MSCs (1.0 × 106/200 μL) or vehicle were intravenously infused on P10. Brain volume was measured using in vivo MRI on P8 and P35. On P35, the rats were sacrificed after their behavior was evaluated using a beam walk test, and their brains were then prepared for histological analyses. RESULTS The MSC-treated group had fewer slips on the beam walk test compared to those in the vehicle group (p = 0.041). MRI was used to measure the volumes of the whole brain, contralateral brain (hemisphere), and residual brain regions of interest, and the results indicated increased brain volume after the intravenous MSC infusions. The histological analyses revealed increased thicknesses of the contralateral cortex and corpus callosum in the MSC group compared with those in the vehicle group (p = 0.021, p = 0.019), which confirmed the volume increases. In the contralateral cortex, the MSC-treated group exhibited significant increases in the numbers of NeuN-positive cells (p = 0.004) and synaptic puncta (p = 0.000) compared with the numbers observed in the vehicle group. CONCLUSIONS The intravenous infusion of MSCs resulted in improvements in functional outcome, increased brain volume, and enhanced synaptogenesis in HI rats.

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