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Professor Nadia Badawi

Macquarie Group Foundation Chair of Cerebral Palsy
PO Box 560, Darlinghurst, New South Wales 2010 Australia

Interventions and Management

1. J Biomech. 2012 Feb 2. [Epub ahead of print]

The Pediatric Upper Limb Motion Index and a temporal-spatial logistic regression: Quantitative analysis of upper limb movement disorders during the Reach & Grasp Cycle.

Butler EE, Rose J.

Department of Bioengineering, Stanford University, Stanford, CA, USA.; Department of Orthopaedic Surgery, Stanford University School of Medicine, Stanford, CA, USA.; Motion & Gait Analysis Laboratory, Lucile Packard Children's Hospital at Stanford, CA, USA.

This study describes a novel pediatric upper limb motion index (PULMI) for children with cerebral palsy (CP). The PULMI is based on three-dimensional kinematics and provides quantitative information about upper limb motion during the Reach & Grasp Cycle. We also report key temporal-spatial parameters for children with spastic, dyskinetic, and ataxic CP. Participants included 30 typically-developing (TD) children (age=10.9±4.1 years) and 25 children with CP and upper limb involvement (age=12.3±3.7 years), Manual Ability Classification System (MACS) levels I-IV. The PULMI is calculated from the root-mean-square difference for eight kinematic variables between each child with CP and the average TD values, and scaled such that the TD PULMI is 100±10. The PULMI was significantly lower among children with CP compared to TD children (Wilcoxon $Z=-5.06$, $p<.0001$). PULMI scores were significantly lower among children with dyskinetic CP compared to spastic CP ($Z=-2.47$, $p<.0135$). There was a strong negative correlation between PULMI and MACS among children with CP (Spearman's $\rho=-.78$, $p<.0001$). Temporal-spatial values were significantly different between CP and TD children: movement time ($Z=4.06$, $p<.0001$), index of curvature during reach ($Z=3.68$, $p=.0002$), number of movement units ($Z=3.72$, $p=.0002$), angular velocity of elbow extension during reach ($Z=-3.96$, $p<.0001$), and transport(1):reach peak velocities ($Z=-2.48$, $p=.0129$). A logistic regression of four temporal-spatial parameters, the Pediatric Upper Limb Temporal-Spatial Equation (PULTSE), correctly predicted 19/22 movement disorder subtypes (spastic versus dyskinetic CP). The PULMI, PULTSE, and key temporal-spatial parameters of the Reach & Grasp Cycle offer a quantitative approach to analyzing upper limb function in children with CP.

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2. Clin Rehabil. 2012 Feb 3. [Epub ahead of print]**Differential effects of rhythmic auditory stimulation and neurodevelopmental treatment/Bobath on gait patterns in adults with cerebral palsy: a randomized controlled trial.**

Kim SJ, Kwak EE, Park ES, Cho SR.

Department of Music Therapy, Ewha Music and Rehabilitation Center, Ewha Womans University, Korea.

Objectives: To investigate the effects of rhythmic auditory stimulation (RAS) on gait patterns in comparison with changes after neurodevelopmental treatment (NDT/Bobath) in adults with cerebral palsy. **Design:** A repeated-measures analysis between the pretreatment and posttreatment tests and a comparison study between groups. **Setting:** Human gait analysis laboratory. **Subjects:** Twenty-eight cerebral palsy patients with bilateral spasticity participated in this study. The subjects were randomly allocated to either neurodevelopmental treatment (n = 13) or rhythmic auditory stimulation (n = 15). **Interventions:** Gait training with rhythmic auditory stimulation or neurodevelopmental treatment was performed three sessions per week for three weeks. Temporal and kinematic data were analysed before and after the intervention. Rhythmic auditory stimulation was provided using a combination of a metronome beat set to the individual's cadence and rhythmic cueing from a live keyboard, while neurodevelopmental treatment was implemented following the traditional method. **Main measures:** Temporal data, kinematic parameters and gait deviation index as a measure of overall gait pathology were assessed. **Results:** Temporal gait measures revealed that rhythmic auditory stimulation significantly increased cadence, walking velocity, stride length, and step length (P < 0.05). Kinematic data demonstrated that anterior tilt of the pelvis and hip flexion during a gait cycle was significantly ameliorated after rhythmic auditory stimulation (P < 0.05). Gait deviation index also showed modest improvement in cerebral palsy patients treated with rhythmic auditory stimulation (P < 0.05). However, neurodevelopmental treatment showed that internal and external rotations of hip joints were significantly improved, whereas rhythmic auditory stimulation showed aggravated maximal internal rotation in the transverse plane (P < 0.05). **Conclusions:** Gait training with rhythmic auditory stimulation or neurodevelopmental treatment elicited differential effects on gait patterns in adults with cerebral palsy.

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3. Res Dev Disabil. 2012 Feb 1;33(3):971-981. [Epub ahead of print]**Deficits in upper limb position sense of children with Spastic Hemiparetic Cerebral Palsy are distance-dependent.**

Smorenburg AR, Ledebt A, Deconinck FJ, Savelsbergh GJ.

Institute for Biomedical Research into Human Movement and Health, School of Health Care Science, Manchester Metropolitan University, John Dalton Building, Oxford Road, Manchester M1 5GD, United Kingdom.

This study examined the arm position sense in children with Spastic Hemiparetic Cerebral Palsy (SHCP) and typically developing children (TD) by means of a contralateral matching task. This task required participants to match the position of one arm with the position of the other arm for different target distances and from different starting positions. Results showed that children with SHCP exhibited with both arms larger matching errors than the TD group, but only when the distance between the arms at the start of the movement was large. In addition, the difference in errors between the less-impaired and the impaired limb changed as a function of the distance in the SHCP group whereas no interlimb differences were found in the TD group. Finally, spasticity and restricted range of motion in children with SHCP were not related to the proportion of undershoot and size of absolute error. This suggests that SHCP could be associated with sensory problems in conjunction with their motor problems. In conclusion, the current study showed that accurate matching of the arms is greatly impaired in SHCP when compared to TD children, irrespective of which arm is used. Moreover, this deficit is particularly present for large movement amplitudes.

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4. Phys Occup Ther Pediatr. 2012 Feb 7. [Epub ahead of print]**Reproducibility of Tactile Assessments for Children with Unilateral Cerebral Palsy.**

Auld ML, Ware RS, Boyd RN, Moseley GL, Johnston LM.

Division of Physiotherapy, School of Health and Rehabilitation Sciences, The University of Queensland, Brisbane, Australia.

A systematic review identified tactile assessments used in children with cerebral palsy (CP), but their reproducibility is unknown. Sixteen children with unilateral CP and 31 typically developing children (TDC) were assessed 2-4 weeks apart. Test-retest percent agreements within one point for children with unilateral CP (and TDC) were Semmes-Weinstein monofilaments: 75% (90%); single-point localization: 69% (97%); static two-point discrimination: 93% (97%); and moving two-point discrimination: 87% (97%). Test-retest reliability for registration and unilateral spatial tactile perception tests was high in children with CP (intraclass correlation coefficient [ICC] = 0.79-0.96). Two tests demonstrated a learning effect for children with CP, double simultaneous and tactile texture perception. Stereognosis had a ceiling effect for TDC (ICC = 0) and variability for children with CP (% exact agreement = 47%-50%). The Semmes-Weinstein monofilaments, single-point localization, and both static and moving two-point discrimination are recommended for use in practice and research. Although recommended to provide a comprehensive assessment, the measures of double simultaneous, stereognosis, and tactile texture perception may not be responsive to change over time in children with unilateral CP.

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5. Curr Rev Musculoskelet Med. 2012 Feb 9. [Epub ahead of print]**Surgical site infection after pediatric spinal deformity surgery.**

Li Y, Glotzbecker M, Hedequist D.

Department of Orthopaedic Surgery, C.S. Mott Children's Hospital, 1540 E. Hospital Drive, Ann Arbor, MI, 48109, USA, yingyuli@med.umich.edu.

The incidence of surgical site infection (SSI) after spinal deformity surgery for adolescent idiopathic scoliosis ranges from 0.5-6.7%. The risk of infection following spinal fusion in patients with neuromuscular scoliosis is greater, with reported rates of 6.1-15.2% for cerebral palsy and 8-41.7% for myelodysplasia. SSIs result in increased patient morbidity, multiple operations, prolonged hospital stays, and significant financial costs. Recent literature has focused on elucidating the most common organisms involved in SSIs, as well as identifying modifiable risk factors and prevention strategies that may decrease the rates of infection. These include malnutrition, positive urine cultures, antibiotic prophylaxis, surgical site antisepsis, antibiotic-loaded allograft, local application of antibiotics, and irrigation solutions. Acute and delayed SSIs are managed differently. Removal of instrumentation is required for effective treatment of delayed SSIs. This review article examines the current literature on the prevention and management of SSIs after pediatric spinal deformity surgery.

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6. J Pediatr Rehabil Med. 2012;4(3):161.**Hip disease in cerebral palsy.**

Neufeld JA.

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7. Work. 2012 Jan 1;41(0):4762-6.**Inclusive design - assistive technology for people with cerebral palsy.**

Heidrich R, Bassani P.

LABIE - Laboratório de Inclusão e Ergonomia. RS-239, 2755, Hamburgo Velho. Novo Hamburgo-RS. CEP 93352-000.

This study reports the work of the Inclusive Design research project conducted with a group of children with cerebral palsy. Our project has been working with Assistive Technology and has been developing an expanded mouse and a keyboard. Nowadays, we are working as a researcher of Cognitive Ergonomics and of Inclusive Education. The goal of our project is to establish an interdisciplinary study that focus the developing of a research in Ergonomics Design, contributing to improve the assistance to people with special needs. Method: One applied the pedagogical approach, using Vygotsky's Social-historic Theory that advocates the concept of each individual's experiences are important to improve them. The development methodology was based on user-centered design. Results: The results showed that as long as the students applied the new technologies they developed superior psychological processes towards social interaction, autonomy, taking part in class activities more efficiently. Also, we verified how important the new technologies in class were, considering the methodologies, objectives full and effective described on this study. This way, we do hope, from the data obtained on this research, to contribute with the ones who believe that the improvement of handicap students' inclusion in class is a reality.

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8. Work. 2012 Jan 1;41(0):3612-5.**Virtual reality based therapy for post operative rehabilitation of children with cerebral palsy.**

Sharan D, Ajeesh PS, Rameshkumar R, Mathankumar M, Paulina RJ, Manjula M.

Address for correspondence: RECOUP Neuromusculoskeletal Rehabilitation Centre, Bangalore, India.

Virtual reality is the use of interactive replication created with computer hardware and software to impart users with opportunities to engage in environments that appear to feel similar to real world objects and events. The commonest rehabilitation program of cerebral palsy children involves stretching, strengthening, mobilization and various other activities, whereas the use of virtual reality based training (VRBT) for rehabilitation of cerebral palsy is not common. To understand the effect of VRBT a study was formulated. Twenty nine subjects participated (study group - 14 and control group - 15). Outcome measures were MACS, PBS, level of participation, motivation, cooperation and satisfaction of the child. Results revealed that balance and manual ability were significantly improved in both the groups (Balance: study: $t=2.28$, $p<0.05$; control: $t=3.5$, $p<0.01$; Manual ability: study: $t=5.58$, $p<0.001$; control: $t=7.06$, $p<0.001$). PBS had significantly greater improvement in the study group ($t=2.02$, $p<0.05$). Level of participation, motivation, cooperation and satisfaction of the child were also reported to be significantly higher among the study group as compared with control group. To the author's best knowledge, this is the first study on using the VR-based therapy for the postoperative rehabilitation of children with CP which need further elaboration with larger sample size.

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9. Work. 2012 Jan 1;41(0):1891-5.**Musculoskeletal disorders in caregivers of children with cerebral palsy following a multilevel surgery.**

Sharan D, Ajeesh P, Rameshkumar R, Manjula M.

RECOUP Neuromusculoskeletal Rehabilitation Centre, Bangalore, India.

The patients of cerebral palsy need assistance for their self activities which expose the caregivers to different risk factors of musculoskeletal disorders. But there is a scarcity of studies revealing the prevalence and the risk factors

present among the caregivers of the cerebral palsy children. This led to formulate a study to identify prevalence and risk factors among the caregivers of cerebral palsy children. Result revealed that most of the caregivers among both the groups were female (63.4% and 69.3%). The common age group of the children who underwent multilevel surgery was at the age group of 6 - 10 years. It has been observed that among the study group 56.5% were totally cooperative children. The Caregiver Strain Index value showed there is no significant difference among both the groups. Regional body pain of shoulder, elbow, upper back, lower back and ankle revealed a higher prevalence among the study group. Clinical diagnosis revealed prevalence of MPS, FMS and TOS among the study group were 27.6%, 24.5% and 23.0% respectively. Study further revealed that cooperativeness of the child was significantly associated with lower back pain, MPS, FMS and TOS among the study group.

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Prevention and Cure

10. Arch Pediatr Adolesc Med. 2012 Feb;166(2):178-84.

Relationship between attrition and neurodevelopmental impairment rates in extremely preterm infants at 18 to 24 months: a systematic review.

Guillén U, Demauro S, Ma L, Zupancic J, Roberts R, Schmidt B, Kirpalani H.

BM, Division of Neonatology, The Children's Hospital of Philadelphia, 34th St & Civic Center Blvd, Philadelphia, PA 19104.. kirpalanih@email.chop.edu.

OBJECTIVE: To assess the effect of loss to follow-up rates at 18 to 24 months on neurodevelopmental outcome statistics for infants of less than 1000 g birth weight or less than 28 weeks' gestational age. **DATA SOURCES:** MEDLINE, EMBASE, PubMed, and Cochrane Library databases (January 1, 2000, to June 30, 2010). **STUDY SELECTION:** We searched for studies reporting outcomes of infants of less than 1000 g birth weight or less than 28 weeks' gestational age who were born after 1990. **Main Exposure** Eligible articles had to report the primary outcome and follow-up rates at 18 to 24 months. **Main Outcome** Our primary composite outcome of neurodevelopmental impairment (NDI) was any of a mental developmental quotient 2 SDs below the mean, using the Bayley Scales of Infant Development II; cerebral palsy; visual impairment; or significant hearing impairment. **RESULTS:** Of 43 publications describing outcomes at 18 to 24 months, 20 provided rates of follow-up, describing a total of 34 185 infants. The NDI rates ranged between 12.4% and 57.5%. Follow-up rates ranged between 71.6% and 100%. Higher rates of NDI were significantly correlated with greater loss to follow-up ($r(2) = 0.38$, $P = .007$). Higher rates of both NDI and loss to follow-up were seen in the United States compared with Canada, the United Kingdom, Finland, Denmark, Austria, Germany, and Australia ($r(2) = 0.70$, $P = .001$). **CONCLUSIONS:** Ascertainment bias may overestimate NDI in extremely low-birth-weight or extremely low-gestational-age survivors at 18 to 24 months. Alternatively, the characteristics of different populations and health systems may contribute to higher rates of attrition and higher rates of NDI.

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11. Brain Dev. 2012 Feb 3. [Epub ahead of print]

A case of bulbar type cerebral palsy: Representative symptoms of dorsal brainstem syndrome.

Hiyane M, Saito Y, Saito T, Komaki H, Nakagawa E, Sugai K, Sasaki M, Sato N, Yamamoto T, Imai Y.

Department of Child Neurology, National Center of Neurology and Psychiatry (NCNP), Kodaira, Tokyo, Japan.

In this study, we present the case of a 2-year-old boy who exhibited facial and bulbar paralysis since birth, severe dysphagia, signs of oculomotor disturbance, jaw jerks, pyramidal signs on both toes, intellectual disability, and severe gastroesophageal reflux. His blink reflex and auditory/somatosensory evoked potentials suggested abnormalities in the lower brainstem, and magnetic resonance imaging showed a T2 hyperintense area in the

pontine tegmentum. These findings combined with the patient's symptoms suggested "dorsal brainstem syndrome" and indicated a possibility of prenatal asphyxia in this patient. Nosologic issues regarding this subgroup of cerebral palsy are discussed here.

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12. J Ethnopharmacol. 2012 Jan 25. [Epub ahead of print]

Neuroprotective effect of Buyang Huanwu Decoction against focal cerebral ischemia/reperfusion injury in rats - Time window and mechanism.

Zhao LD, Wang JH, Jin GR, Zhao Y, Zhang HJ.

Department of Neurology, The Xuzhou Medical College Affiliated Huai'an Hospital, Huai'an, Jiangsu, China.

ETHNOPHARMACOLOGICAL RELEVANCE: Buyang Huanwu Decoction, a traditional Chinese medicine, consists of different herbal medicines, and has been traditionally used for centuries to treat paralysis and stroke. However, its optimal therapeutic time window and the mechanism are still unclear. **AIM OF THE STUDY:** This study was designed to explore the therapeutic time window and mechanism of Buyang Huanwu Decoction on transient focal cerebral ischemia/reperfusion injury. **MATERIALS AND METHODS:** Middle cerebral artery occlusion was conducted in male Sprague-Dawley rats, and 40g/kg of Buyang Huanwu Decoction was intragastrically infused at different time points, and the same dose was infused every 24h for 3 days. The level of glutamate in cerebrospinal fluid and the expression of metabotropic glutamate receptor-1 RNA in striatum were detected before, during, and after ischemia/reperfusion. Neurological deficit scores and brain infarction volumes were measured at 72h after reperfusion. **RESULT:** Cerebral ischemia/reperfusion resulted in significant neurological deficit and extensive cerebral infarct volume, associated with a large amount of glutamate in cerebrospinal fluid and elevation of metabotropic glutamate receptor-1 RNA expression. Buyang Huanwu Decoction significantly suppressed the release of glutamate, and reduced the expression of metabotropic glutamate receptor-1 RNA. The neurological defect score and infarction volume were significantly improved by administration of Buyang Huanwu Decoction, when compared with the Ischemia group. **CONCLUSIONS:** Administration of Buyang Huanwu Decoction, within 4h of post-transient focal stroke, reduced significant cerebral ischemia/reperfusion damage. The neuroprotective mechanism of Buyang Huanwu Decoction is, in part, associated with the down-regulation of metabotropic glutamate receptor-1 RNA and inhibition of glutamate release resulting from cerebral ischemia.

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13. J Matern Fetal Neonatal Med. 2012 Feb 6. [Epub ahead of print]

Chorioamnionitis- the good or the evil for neonatal outcome?

Bersani I, Thomas W, Speer CP.

University Children's Hospital, University of Würzburg, Germany.

Chorioamnionitis represents a major risk factor for preterm birth and contributes to prematurity-associated morbidity and mortality. Comparison of studies addressing neonatal outcome after exposure to either histological or clinical chorioamnionitis is hampered by the great heterogeneity regarding study cohorts and disease definitions which were applied. Moreover, the impact of exposure to inflammation in utero on neonatal outcome has become less evident with major advances in perinatal and neonatal care. Histologic chorioamnionitis evidently is associated with a reduction of incidence and severity of respiratory distress syndrome. Short term maturational effects on the lungs of ventilated extremely premature infants are, however, accompanied by a greater susceptibility of the lung, eventually contributing to an increased risk of bronchopulmonary dysplasia. Chorioamnionitis has been shown associated with increased rate of early-onset sepsis but, according to recent data, histological chorioamnionitis might be protective against late-onset sepsis. Inconsistent data exist concerning the true role of chorioamnionitis in

the development of brain lesions such as cystic periventricular leukomalacia, diffuse white matter disease, and intraventricular hemorrhage. However, an association with the development of cerebral palsy has been reported.

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