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Interventions and Management

1. Objective measurement of sitting - Application in children with cerebral palsy

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Gait Posture. 2022 Jun 3;96:210-215. doi: 10.1016/j.gaitpost.2022.05.039. Online ahead of print.

Background: Children with cerebral palsy (CP) and a severe motor impairment, have limited ability to perform volitional movements due to spasticity, involuntary postures and movements and reduced ability to maintain antigravity head and trunk control. A stable sitting position is a prerequisite for participation in daily life, but there is a lack of objective measurement methods for this population. **Research question:** Is it feasible to measure a stable sitting position with pressure mapping and 2D motion analysis, and can it detect differences to a) a reference group, b) between subgroups of CP and c) before and after treatment with intrathecal baclofen (ITB)? **Methods:** Pressure mapping, and a 2D motion analysis system, were used to capture movements of centre of pressure (CoP), and movements of head, hand and leg, sitting on a bench for 90 s. Twenty-two children with dyskinetic or bilateral spastic CP, GMFCS III-V, mean age 9.0, and 30 children with typical development (TD) mean age 10.7, were recruited between 2010 and 2019. Seventeen children were treated with ITB. Parents were interviewed regarding aspect of sitting. **Non-parametric methods** were used for statistical analysis. **Results:** Differences in CoP and kinematics were detected with more movements in children with CP compared to children with TD ($p < 0.001$). There were more movements in children with dyskinetic CP compared to children with bilateral spastic CP as captured with the pressure mapping system (CoP distance $p = .005$ and Anterior-Posterior sway $p = .014$). After treatment with ITB, involuntary movements had decreased (CoP $p = 0.006-0.035$, kinematics $p = 0.002-0.020$). Parents reported improvement in sitting. The two measurement systems showed consistent results ($\rho 0.500-0.771$, $p = <0.001-0.049$). **Significance:** It was feasible to objectively measure sitting position in children with a moderate-to-severe motor impairment with differences to a reference group and after an intervention. CoP and head movements were the variables that were easiest to capture.

PMID: [35700638](#)

2. 'Finding what works for me' - a qualitative study of factors influencing community gym participation for young adults with cerebral palsy

Georgia McKenzie, Nora Shields, Claire Willis

Disabil Rehabil. 2022 Jun 12;1-8. doi: 10.1080/09638288.2022.2083243. Online ahead of print.

Purpose: To understand the factors influencing participation in community-based gym exercise for young adults with cerebral palsy (CP). **Methods:** A qualitative study using semi-structured interviews was conducted. Interviews were completed with 39 young adults with CP (15-30 years, GMFCS I-IV) following a peer-supported, gym-based exercise program called FitSkills. **Results:** "Finding what works for me" was the overarching theme. Through their gym experiences, young adults with CP identified four interrelated main themes that influenced whether gym participation "worked" for them, or not: (i)

psychological factors, (ii) a "social" participation context, (iii) organisational and logistical support, and (iv) cost. The social context of FitSkills was perceived to positively influence psychological health outcomes and attenuate perceived barriers to participation. Organisational support facilitated their initial attendance, while logistical effort and cost affected ongoing or future gym participation. Conclusions: Social involvement plays a critical role in positive participation experiences in community exercise settings for young adults with CP. Clinicians supporting exercise participation for this group should prioritise intervention strategies that promote social engagement and mental wellbeing. Collaboration between clinicians, community leisure organisations, and funding bodies may be essential to overcome logistical and financial barriers during the transition to adulthood. Implications for rehabilitation. The main factor influencing the attendance, involvement, and ongoing exercise preferences of young adults with cerebral palsy (CP) was the social context of the participation experience. Altering the social environment through peer-mentoring can facilitate participation in the gym. Young adults with CP consider mental wellbeing to be an important motivator and outcome of gym-based exercise participation. Mental wellbeing should be prioritised for health promotion for this group. Collaboration between recreation organisations, health services, clinicians, and consumers to address logistical and financial factors can facilitate positive physical activity participation experiences in community settings.

PMID: [35694973](#)

3. A Novel Technique for Occipitocervical Fusion with Triple Rod Connection to Prevent Implant Failure

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Case Reports Cureus. 2022 May 8;14(5):e24821. doi: 10.7759/cureus.24821. eCollection 2022 May.

Occipitocervical fusion is an effective surgical method for treating various upper cervical disorders. However, complications such as implant failure due to rod breakage have been reported. Therefore, we devised a surgical technique for occipitocervical fusion with a triple rod connection to prevent implant failure. Occipitocervical fusion with triple rod connection was performed in two cases with a high risk of instability such as athetoid cerebral palsy and rheumatoid arthritis. A multiaxial screw (diameter: 4.5 mm) was inserted into the screw hole in the middle of the occipital plate, and subsequently, an additional rod was attached. It was connected to the main rod using an offset connector at the caudal side. The connection of the additional rod was simple and did not interfere with the fusion bed for bone graft between the occipital bone and axis. The head of the screw was crimped to the occipital plate, and the plate was firmly fixed. Moreover, since the head of the screw did not protrude to the dorsal side, the tension of the soft tissue and skin did not increase. No complications occurred after surgery in both cases. In addition, no special instruments were required to connect the additional rod to the main rod in this procedure. Therefore, our technique may be useful as an option to prevent implant failure due to rod breakage at the craniocervical junction.

PMID: [35693373](#)

4. The Myotube Analyzer: how to assess myogenic features in muscle stem cells

Simon Noë, Marlies Corvelyn, Sarah Willems, Domiziana Costamagna, Jean-Marie Aerts, Anja Van Campenhout, Kaat Desloovere

Skelet Muscle. 2022 Jun 10;12(1):12. doi: 10.1186/s13395-022-00297-6.

Background: The analysis of in vitro cultures of human adult muscle stem cells obtained from biopsies delineates the potential of skeletal muscles and may help to understand altered muscle morphology in patients. In these analyses, the fusion index is a commonly used quantitative metric to assess the myogenic potency of the muscle stem cells. Since the fusion index only partly describes myogenic potency, we developed the Myotube Analyzer tool, which combines the definition of the fusion index with extra features of myonuclei and myotubes obtained from satellite cell cultures. Results: The software contains image adjustment and mask editing functions for preprocessing and semi-automatic segmentation, while other functions can be used to determine the features of nuclei and myotubes. The fusion index and a set of five novel parameters were tested for reliability and validity in a comparison between satellite cell cultures from children with cerebral palsy and typically developing children. These novel parameters quantified extra nucleus and myotube properties and can be used to describe nucleus clustering and myotube shape. Two analyzers who were trained in cell culture defined all parameters using the Myotube Analyzer app. Out of the six parameters, five had good reliability reflected by good intra-class correlation coefficients (> 0.75). Children with cerebral palsy were significantly different from the typically developing children ($p < 0.05$) for five parameters, and for three of the six parameters, these differences exceeded the minimal detectable differences. Conclusions: The Myotube Analyzer can be used for the analysis of fixed differentiated myoblast cultures with nuclear and MyHC staining. The app can calculate the fusion index, an already existing parameter, but also provides multiple new parameters to comprehensively describe myogenic potential in its output. The raw data used to determine these parameters are also available in the output. The parameters calculated by the tool can be used to detect differences between cultures from children with cerebral palsy and typically

developing children. Since the program is open source, users can customize it to fit their own analysis requirements.

PMID: [35689270](#)

5. Analysis of sedation and general anesthesia in patients with special needs in dentistry using the Korean healthcare big data

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J Dent Anesth Pain Med. 2022 Jun;22(3):205-216. doi: 10.17245/jdapm.2022.22.3.205. Epub 2022 May 27.

Background: People with special needs tend to require diverse behavioral management in dentistry. They may feel anxious or uncomfortable or may not respond to any communication with the dentists. Patients with medical, physical, or psychological disorders may not cooperate and therefore require sedation (SED) or general anesthesia (GA) to receive dental treatment. Using the healthcare big data in Korea, this study aimed to analyze the trends of SED and GA in special needs patients undergoing dental treatment. It is believed that these data can be used as reference material for hospitals and for preparation of guidelines and related policy decisions of associations or governments for special needs patients in dentistry. **Methods:** The study used selected health information data provided by the Korean National Health Insurance Service. Patients with a record of use of one of the eight selected drugs used in dental SED between January 2007 and September 2019, those with International Classification of Diseases-10 codes for attention deficit hyperactivity disorder (ADHD), phobia, brain disease, cerebral palsy, epilepsy, genetic disease, autism, mental disorder, mental retardation, and dementia were selected. The insurance claims data were analyzed for age, sex, sedative use, GA, year, and institution. **Results:** The number of special needs patients who received dental treatment under SED or GA from January 2007 to September 2019 was 116,623. Number of SED cases was 136,018, performed on 69,265 patients, and the number of GA cases was 56,308, implemented on 47,257 patients. In 2007, 3100 special needs patients received dental treatment under SED while in 2018 the number of cases increased 6 times to 18,528 SED cases. In dentistry, ADHD was the most common disability for SED cases while phobia was the most common cause of disability for GA. The male-to-female ratio with respect to SED cases was higher for males (M: F = 64.36% : 35.64%). **Conclusion:** The application of the SED method and GA for patients with special needs in dentistry is increasing rapidly; thus, preparing guidelines and reinforcing the education and system are necessary.

PMID: [35693353](#)

6. The predictive ability of the Lacey Assessment of Preterm Infants (LAPI), Cranial Ultrasound (cUS) and General Movements Assessment (GMA) for Cerebral Palsy (CP): A prospective, clinical, single center observational study

Claire Marcroft, Patricia Dulson, Jennifer Dixon, Nicholas Embleton, Anna Purna Basu

Early Hum Dev. 2022 May 21;105589. doi: 10.1016/j.earlhumdev.2022.105589. Online ahead of print.

Background and aim: The LAPI, cUS and GMA are assessments used clinically in the UK to identify preterm infants at high risk of neurodevelopmental disabilities such as cerebral palsy. This study investigated the ability of these assessments to predict cerebral palsy at 2 years corrected gestational age. **Methods:** Design: Prospective longitudinal cohort study including infants born <30 weeks' gestation from a single tertiary neonatal intensive care unit. The LAPI and cUS were undertaken as part of routine care before term equivalent age and the GMA was undertaken at 11-18 weeks corrected gestational age. **Results:** There were 123 eligible infants and 95 infants (77.2%) were included. Thirteen infants (13.7%) had a diagnosis of CP at 2 years. There was no significant difference in gestational age, gender, or birth weight between the groups with and without a diagnosis of CP. The highest accuracy of prediction of CP was achieved by an aberrant, absent fidgety general movements classification with a sensitivity of 92.3% and specificity of 98.9%. Combining the GMA to include the cUS or LAPI did not increase the predictive accuracy. **Conclusion:** The GMA when undertaken in clinical practice had high accuracy for predicting CP at 2 years corrected age in infants born <30 weeks gestation; LAPI and cUS did not improve this accuracy.

PMID: [35690549](#)

7. Excitability of the radiculo-medullary circuitry in spastic cerebral palsy: An intraoperative neurophysiological study in children undergoing selective dorsal rhizotomy

Marc Sindou, George Georgoulis, Anthony Joud, Eleftherios Neromyliotis, Argyrios Dinopoulos

Dev Med Child Neurol. 2022 Jun 14. doi: 10.1111/dmcn.15315. Online ahead of print.

Aim: To explore - through intraoperative neurophysiology mapping and recordings - the comparative distribution of the reflexive excitability of the L2 to S2 radiculo-metameric segments of the spinal cord in a series of children with bilateral spastic cerebral palsy (CP) who underwent selective dorsal rhizotomy (SDR). **Method:** Our series included 46 consecutive children (36 males, 10 females; aged 5-16 years, mean 8 years) who underwent SDR, using keyhole interlaminar dorsal rhizotomy. The procedure allowed access to all L2 to S2 roots independently, while preserving the posterior architecture of the lumbar spine. Dorsal roots were stimulated selectively to test reflexive excitability of the corresponding radiculo-metameric levels. Stimulation parameters were identical for all roots for optimal comparison between root levels, with an intensity just above threshold to avoid excessive diffusion. The responses in the main muscular groups in each lower limb were clinically observed and electromyograms recorded. Degrees of excitability were quantified according to Fasano's scale. **Results:** The difference between root levels was highly significant. Median values of excitability were 1, 2, 3, 3, 3, and 3 for the L2, L3, L4, L5, S1, and S2 levels respectively. Lower root levels exhibited significantly more excitability. **Interpretation:** In addition to insight into the spasticity of children with CP, the profile of segmental excitability can be useful in establishing surgical planning when programming SDR.

PMID: [35698904](#)

8. Differential Gene Expression in Cord Blood of Infants Diagnosed with Cerebral Palsy: a Pilot Analysis of the BEAM Cohort

Maria L V Dizon, Raye-Ann O deRegnier, Steven J Weiner, Michael W Varner, Dwight J Rouse, Maged M Costantine, Ronald J Wapner, John M Thorp, Sean C Blackwell, Nina K Ayala, Antonio F Saad, Steve N Caritis, Eunice Kennedy Shriver National Institute of Child Health

Dev Neurosci. 2022 Jun 15. doi: 10.1159/000525483. Online ahead of print.

The Beneficial Effects of Antenatal Magnesium (BEAM) clinical trial was conducted between 1997-2007, and demonstrated a significant reduction in cerebral palsy (CP) in preterm infants who were exposed to peripartum magnesium sulfate (MgSO₄). However, the mechanism by which MgSO₄ confers neuroprotection remains incompletely understood. Cord blood samples from this study were interrogated during an era when next generation sequencing was not widely accessible and few gene expression differences or biomarkers were identified between treatment groups. Our goal was to use bulk RNA deep sequencing to identify differentially expressed genes comparing the following four groups: newborns who ultimately developed CP treated with MgSO₄ or placebo, and controls (newborns who ultimately did not develop CP) treated with MgSO₄ or placebo. Those who died after birth were excluded. We found that MgSO₄ upregulated expression of SCN5A only in the control group, with no change in gene expression in cord blood of newborns who ultimately developed CP. Regardless of MgSO₄ exposure, expression of NPBWR1 and FTO were upregulated in cord blood of newborns who ultimately developed CP compared with controls. These data support that MgSO₄ may not exert its neuroprotective effect through changes in gene expression. Moreover, NPBWR1 and FTO may be useful as biomarkers, and may suggest new mechanistic pathways to pursue in understanding the pathogenesis of CP. The small number of cases ultimately available for this secondary analysis, with male predominance and mild CP phenotype, is a limitation of the study. In addition, differentially expressed genes were not validated by qRT-PCR.

PMID: [35705018](#)

9. Placental Pathology and Neonatal Encephalopathy

Aine Fox, Emma Doyle, Michael Geary, Breda Hayes

Review Int J Gynaecol Obstet. 2022 Jun 13. doi: 10.1002/ijgo.14301. Online ahead of print.

Neonatal encephalopathy (NE) is an important cause of neonatal morbidity and mortality worldwide however there remain many gaps in our knowledge about its pathogenesis. The placenta has been implicated in the pathogenesis of this disease but conclusive evidence related to the placental factors that influence it is sparse. This review aims to outline the current knowledge on the role of the placenta with particular attention to its role in NE as a consequence of hypoxia-ischaemia. Twenty-six original articles/review papers were used to compile this review. Three themes were identified from these publications: Fetal vascular malperfusion including umbilical cord pathology, inflammatory changes in the placenta and maternal vascular malperfusion including placental weight. These features were identified as being significant in the development of NE. Advancing our understanding of this relationship between placental pathology and NE may facilitate the development of additional antenatal screening to better identify at risk fetuses. This paper highlights areas for further research through antenatal screening and placental histology.

PMID: [35694848](#)

10. Autologous cellular therapy for cerebral palsy: a randomized, crossover trial

Charles S Cox Jr, Jenifer Juranek, Steven Kosmach, Claudia Pedroza, Nivedita Thakur, Allison Dempsey, Kimberly Rennie, Michael C Scott, Margaret Jackson, Akshita Kumar, Benjamin Aertker, Henry Caplan, Fabio Triolo, Sean I Savitz

Brain Commun. 2022 May 20;4(3):fcac131. doi: 10.1093/braincomms/fcac131. eCollection 2022.

We examined an autologous mononuclear-cell-therapy-based approach to treat cerebral palsy using autologous umbilical cord blood or bone-marrow-derived mononuclear cells. The primary objective was to determine if autologous cells are safe to administer in children with cerebral palsy. The secondary objectives were to determine if there was improvement in motor function of patients 12 months after infusion using the Gross Motor Function Measure and to evaluate impact of treatment on corticospinal tract microstructure as determined by radial diffusivity measurement. This Phase 1/2a trial was a randomized, blinded, placebo-controlled, crossover study in children aged 2-10 years of age with cerebral palsy enrolled between November 2013 and November 2016. Participants were randomized to 2:1 treatment:placebo. Treatment was either autologous bone-marrow-derived mononuclear cells or autologous umbilical cord blood. All participants who enrolled and completed their baseline visit planned to return for follow-up visits at 6 months, 12 months and 24 months after the baseline visit. At the 12-month post-treatment visit, participants who originally received the placebo received either bone-marrow-derived mononuclear cell or umbilical cord blood treatment. Twenty participants were included; 7 initially randomized to placebo, and 13 randomized to treatment. Five participants randomized to placebo received bone-marrow-derived mononuclear cells, and 2 received umbilical cord blood at the 12-month visit. None of the participants experienced adverse events related to the stem cell infusion. Cell infusion at the doses used in our study did not dramatically alter motor function. We observed concordant bilateral changes in radial diffusivity in 10 of 15 cases where each corticospinal tract could be reconstructed in each hemisphere. In 60% of these cases (6/10), concordant decreases in bilateral corticospinal tract radial diffusivity occurred post-treatment. In addition, 100% of unilateral corticospinal tract cases (3/3) exhibited decreased corticospinal tract radial diffusivity post-treatment. In our discordant cases (n = 5), directionality of changes in corticospinal tract radial diffusivity appeared to coincide with handedness. There was a significant improvement in corticospinal tract radial diffusivity that appears related to handedness. Connectivity strength increased in either or both pathways (cortico-striatal and thalamo-cortical) in each participant at 12 months post-treatment. These data suggest that both stem cell infusions are safe. There may be an improvement in myelination in some groups of patients that correlate with small improvements in the Gross Motor Function Measure scales. A larger autologous cord blood trial is impractical at current rates of blood banking. Either increased private banking or matched units would be required to perform a larger-scale trial.

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