Cerebral Palsy Alliance

NEWS
Cerebral Palsy Research

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Interventions and Management

1. Closed-Loop Hybrid Gaze Brain-Machine Interface Based Robotic Arm Control with Augmented Reality Feedback.

Zeng H, Wang Y, Wu C, Song A, Liu J, Ji P, Xu B, Zhu L, Li H, Wen P.

Front Neurorobot. 2017 Oct 31;11:60. doi: 10.3389/fnbot.2017.00060. eCollection 2017.

Brain-machine interface (BMI) can be used to control the robotic arm to assist paralysis people for performing activities of daily living. However, it is still a complex task for the BMI users to control the process of objects grasping and lifting with the robotic arm. It is hard to achieve high efficiency and accuracy even after extensive trainings. One important reason is lacking of sufficient feedback information for the user to perform the closed-loop control. In this study, we proposed a method of augmented reality (AR) guiding assistance to provide the enhanced visual feedback to the user for a closed-loop control with a hybrid Gaze-BMI, which combines the electroencephalography (EEG) signals based BMI and the eye tracking for an intuitive and effective control of the robotic arm. Experiments for the objects manipulation tasks while avoiding the obstacle in the workspace are designed to evaluate the performance of our method for controlling the robotic arm. According to the experimental results obtained from eight subjects, the advantages of the proposed closed-loop system (with AR feedback) over the open-loop system (with visual inspection only) have been verified. The number of trigger commands used for controlling the robotic arm to grasp and lift the objects with AR feedback has reduced significantly and the height gaps of the gripper in the lifting process have decreased more than 50% compared to those trials with normal visual inspection only. The results reveal that the hybrid Gaze-BMI user can benefit from the information provided by the AR interface, improving the efficiency and reducing the cognitive load during the grasping and lifting processes.

PMID: 29163123

2. Slow correction of severe spastic hyperlordosis in an adult by means of magnetically expandable rods.

Birkenmaier C, D'Anastasi M, Wegener B, Melcher C.

Eur Spine J. 2017 Nov 22. doi: 10.1007/s00586-017-5366-2. [Epub ahead of print]

BACKGROUND: We describe a case of severe and progressive lumbar hyperlordosis (160°) in a 28-year-old female university student with cerebral palsy. Her main complaints were abdominal wall pain and increasing inability to sit in her custom wheelchair. METHOD: When deciding on our opinion about the most promising treatment strategy, we contemplated slow continued correction by means of percutaneously expandable magnetic rods (MAGEC) after the index surgery as a key component of a satisfactory correction in this severe and rigid curve. After an initial radical release and partial correction, a release and correction procedure was required for the bilateral hip flexion contracture. A final in situ posterior fusion was performed as a second spinal procedure, once the desired final correction at 66° of lumbar lordosis was achieved. RESULT: Three years after the completion of surgery, the patient has a stable clinical and radiological result as well as a solid posterior fusion on CT. CONCLUSION: This is the first case published in which percutaneous magnetic distraction was successfully used in an adult patient.

PMID: 29167992

3. Long-term development of gait after multilevel surgery in children with cerebral palsy: a multicentre cohort study.

Dreher T, Thomason P, Švehlík M, Döderlein L, Wolf SI, Putz C, Uehlein O, Chia K, Steinwender G, Sangeux M, Graham HK.

Dev Med Child Neurol. 2017 Nov 24. doi: 10.1111/dmcn.13618. [Epub ahead of print]

AIM: We investigated the long-term efficacy and safety of multilevel surgery (MLS) in ambulatory children with bilateral spastic cerebral palsy (CP). METHOD: Two hundred and thirty-one children were evaluated at short term (1.1y, SD 0.4) and long term (9.1y, SD 3.0) follow-up using clinical examination and gait analysis. MLS was investigated by studying changes in the Gait Profile Score (GPS) referenced to the minimally important clinical difference. RESULTS: Ambulatory children aged 10 years and 7 months (SD 2y 11mo) at MLS in Gross Motor Function Classification System levels I (19), II (144), and III (68) showed a decrease (improvement) in preoperative GPS from 16.3° (SD 4.8) to 11.3° (SD 3.2) at short-term follow-up, an improvement of 5°. At long-term follow-up, GPS was maintained at 11.4° (SD 3.1). Overall, 177 (76.6%) children maintained their improvement in GPS after 9 years. INTERPRETATION: Multilevel surgery is a safe and effective surgical intervention, which leads to a significant improvement in gait kinematics in children with bilateral spastic CP. This study improves our understanding of MLS in the long term and will help to inform families and children when planning for MLS. WHAT THIS PAPER ADDS: Largest study of multilevel surgery (MLS) for children with bilateral spastic cerebral palsy, with longest follow-up. MLS resulted in significant long-term improvements in gait function. Minor adverse events were common, while events requiring intervention were uncommon (4% of children). Thirty-nine per cent of children required additional surgery during follow-up. 'Single-event multilevel surgery' was changed to the more realistic term 'multilevel surgery'.

PMID: 29171016

4. Effect of robotic-assisted gait rehabilitation on dynamic equilibrium control in the gait of children with cerebral palsy.

Wallard L, Dietrich G, Kerlirzin Y, Bredin J.

Gait Posture. 2017 Nov 11;60:55-60. doi: 10.1016/j.gaitpost.2017.11.007. [Epub ahead of print]

Due to the intensity and repetition of movement, roboticassisted gait training therapy could have a beneficial effect on the recovery and improvement of postural and locomotor functions of the patient. This study sought to highlight the effects of robotic-assisted gait rehabilitation in gait of children with Cerebral Palsy (CP). We analyzed the different strategies before and after this rehabilitation which was used in order to generate forward motion while maintaining balance. Data were collected by a motion analysis system (Vicon® - Oxford Metrics, Oxford, UK). The children were divided into two groups in such a way as to obtain a randomized controlled population: i) a group of fourteen children (Treated Group) underwent 20 sessions of roboticassisted gait training therapy using the driven gait orthosis Lokomat®Pediatric (Hocoma AG, Volketswil, Switzerland) compared to ii) a group of sixteen children without sessions of Lokomat®Pediatric (Control Group). Significant differences are observed for the TG between the preand post-test values of the locomotor parameters and of the kinetic data of the propulsive forces of the Center of Mass (COM) and of the Center of Pressure (COP) dynamic trajectory. This first study, although performed on a limited number of patients, shows the usefulness of this robotic gait rehabilitation mainly in the balance control in gait. Indeed after this rehabilitation, these children improve their gait that is especially characterized by a more appropriate time lag between the time instant of COM-COP trajectory divergence and the time instant when the forward propulsive forces became apparent.

PMID: 29156378

5. Understanding frames: A qualitative study of young people's experiences of using standing frames as part of postural management for cerebral palsy.

Goodwin J, Lecouturier J, Crombie S, Smith J, Basu A, Colver A, Kolehmainen N, Parr JR, Howel D, McColl E, Roberts A, Miller K, Cadwgan J.

Child Care Health Dev. 2017 Nov 23. doi: 10.1111/cch.12540. [Epub ahead of print]

BACKGROUND: Consensus opinion supports standing frame use as part of postural management for nonambulant young people with cerebral palsy. Although the rationale for standing frame use and the associated challenges have been described, little attention has been given to the users' experiences. The aim of the current study was to explore young people's positive and negative experiences, and attitudes regarding standing frame use. METHODS: Framework analysis informed an open exploration of young people's opinions of standing frames. Using semistructured interviews, 12 young people with cerebral palsy (6 female) were interviewed, providing the data set for transcription and thematic analysis. FINDINGS: The first theme

"attitudes to standing frames" describes the young people's understanding of why they use standing frames. Although standing frames can be painful, some young people believe they should be endured to improve their body structure and function. There were mixed views about the impact standing frames have socially, with some young people feeling excluded from their peers, and others feeling as though standing frames helped them "fit in." Some young people are not offered a choice about how and when they use their standing frame. The second theme "challenges of standing frame use" highlights the issues with standing frame use such as manual handling, interference from siblings, and the lack of aesthetically pleasing standing frame designs. CONCLUSIONS: Young people report benefits related to choice, pain relief, and participation but can also cause pain, discomfort, and reduced independence and participation. Healthcare professionals should have open, informative conversations about potential benefits and challenges of standing frames on all aspects of the young people's lives, including participation and activity. Key messages Young people value their standing frame and perceive benefits such as pain relief and participation. However, standing frames can also cause pain, discomfort, and reduce independence and participation. Most young people value having a choice about the type of standing frame they use and the environment they use it in. An exploration of each young person's personal goals and experiences as well as therapeutic outcomes is necessary when prescribing standing frames. There is a need for high quality research to demonstrate the benefits and the disadvantages of standing frames so that young people, their families, and professionals can make informed decisions about standing frame use.

PMID: 29168216

6. Effectiveness of Neuro-Developmental Treatment (bobath concept) on postural control and balance in Cerebral Palsied Children.

Tekin F, Kavlak E, Cavlak U, Altug F.

J Back Musculoskelet Rehabil. 2017 Nov 17. doi: 10.3233/BMR-170813. [Epub ahead of print]

BACKGROUND AND OBJECTIVE: The aim of this study was to show the effects of an 8-week Neurodevelopmental Treatment based posture and balance training on postural control and balance in diparetic and hemiparetic Cerebral Palsied children (CPC). METHODS: Fifteen CPC (aged 5-15 yrs) were recruited from Denizli Yağmur Çocukları Rehabilitation Centre. Gross Motor Function Classification System, Gross Motor Function Measure, 1-Min Walking Test, Modified Timed Up and Go Test, Paediatric Balance Scale, Functional Independence Measure for Children and Seated Postural Control Measure were used for assessment before and after treatment. An 8-week NDT based posture and balance training was applied to the CPC in one session (60-min) 2 days in a week. RESULTS: After the treatment program, all participants showed statistically significant improvements in terms of gross motor function ($p< 0.05$). They also showed statistically significant improvements about balance abilities and independence in terms of daily living activities ($p< 0.05$). Seated Postural Control Measure scores increased after the treatment program ($p< 0.05$). CONCLUSIONS: The results of this study indicate that an 8-week Neurodevelopmental Treatment based posture and balance training is an effective approach in order to improve functional motor level and functional independency by improving postural control and balance in diparetic and hemiparetic CPC.

PMID: 29171980

7. Prolonged stretching of the ankle plantarflexors elicits muscle-tendon adaptations relevant to ankle gait kinetics in children with spastic cerebral palsy.

Martín Lorenzo T, Rocon E, Martínez Caballero I, Ramírez Barragán A, Lerma Lara S.

Med Hypotheses. 2017 Nov;109:65-69. doi: 10.1016/j.mehy.2017.09.025. Epub 2017 Sep 28.

Tissue related ankle hyper-resistance has been reported to contribute to equinus gait in children with spastic cerebral palsy. Hence, ankle plantarflexor stretching programs have been developed in order to restore passive ankle dorsiflexion. Despite high quality evidence on the limited effects of stretching on passive joint mobility, further muscle-tendon adaptations have been reported which may impact gait performance. As such, children with spastic cerebral palsy subject to long-term manual static stretching achieved dorsiflexion gains through the reduction of muscle and fascicle strain whilst preserving tendon strain, and prolonged use of ankle-foot orthoses achieved similar dorsiflexion gains through increased tendon strain whilst preserving muscle and fascicle strain. The latter concurred with normalization of early stance plantarflexor moment yet reductions in push-off plantarflexor moment given the increase in tendon compliance. Therefore, similar limited gains in passive ankle joint mobility in response to stretching may be achieved either by preserving/restoring optimal muscle-tendon function, or at the expense of muscle-tendon function and thus contributing gait impairments. The largest increase in ankle passive joint mobility in children with SCP has been obtained through prolonged plantarflexor stretching through ankle casting combined with botulinum neurotoxin type A. However, to our knowledge, there are no published studies on muscle-tendinous adaptations to ankle casting combined with botulinum toxin type A and its effect on ankle joint gait kinetics. Therefore, we hypothesized that ankle casting elicits muscle-tendon adaptations which concur with altered ankle joint kinetics during the stance phase of gait in children with SCP. More information is needed about the relationships between muscle structure and function, and the effect of specific interventions designed to alter muscle properties and associated functional outcomes in children with spastic cerebral palsy.

PMID: 29150297

8. BTX-A has notable effects contradicting some treatment aims in the rat triceps surae compartment, which are not confined to the muscles injected.

Yucesoy CA, Ateş F.

J Biomech. 2017 Nov 6. pii: S0021-9290(17)30575-4. doi: 10.1016/j.jbiomech.2017.10.035. [Epub ahead of print]

Botulinum toxin type-A (BTX-A) is widely used in treating gastrocnemius medial (GM) and lateral (GL) muscles in cerebral palsy to improve joint motion. However, recent animal experiments indicate inferior BTX-A effects beyond the injected muscle. The goal was to test the following hypotheses in a rat model. (1) BTX-A injected into the GM and GL does not spread into the soleus (SOL), and muscles exposed show (2) a wider length range of force exertion (Lrange), (3) reduced passive forces and (4) no intermuscular interaction effects. Confirming them was considered to indicate BTX-A effects in agreement with the treatment aims and confined to the target muscles. Two groups of Wistar rats were tested: Control (no BTX-A injected) and BTX (0.1 units of BTX-A were injected to the GM and GL, each). GM-GL and SOL muscle distal isometric forces were measured after GM-GL lengthening (condition-1, in which SOL length was kept constant) and with added SOL lengthening (condition-2). Five-days post, BTX-A injection caused significant effects: (1) all muscles showed force drops (minimally by 45%) indicating spread into the SOL. (2) Lrange of GM-GL (conditions-1 and 2) and SOL (condition-2) decreased (up to 25%). (3) Passive forces showed no change (condition-1) or opposite-coupled changes for the GM-GL (decrease by 26.6%) and SOL (increase by 25.4%) (condition-2). Intramuscular connective tissues of all muscles increased. (4) Intermuscular interactions affected BTX-A effects (e.g., GM-GL force drop increased by 48.7% in condition-2 vs. 1). Rejected hypotheses indicate complex widespread BTX-A effects contradicting some treatment aims, hence clinical testing.

PMID: 29154085

9. Oropharyngeal Dysphagia and Cerebral Palsy.

Benfer KA, Weir KA, Bell KL, Ware RS, Davies PSW, Boyd RN.

Pediatrics. 2017 Nov 22. pii: e20170731. doi: 10.1542/peds.2017-0731. [Epub ahead of print]

OBJECTIVES: To determine the progression of oropharyngeal dysphagia (OPD) in preschool-aged children with cerebral palsy (CP) according to gross motor function. It was hypothesized that fewer children would have OPD at 60 months compared with 18 to 24 months (predominately Gross Motor Function Classification System [GMFCS] I-II). METHODS: Longitudinal population-based cohort of 179 children (confirmed CP diagnosis, born in Queensland in 2006-2009, aged 18-60 months at study entry [mean = 34.1 months ± 11.9; 111 boys; GMFCS I = 46.6%, II = 12.9%, III = 15.7%, IV = 10.1%, and V = 14.6%]). Children had a maximum of 3 assessments (median = 3, total n = 423 assessments). OPD was classified by using the Dysphagia Disorders Survey part 2 and rated from video by a certified pediatric speech pathologist. GMFCS was used to classify children's gross motor function. RESULTS: OPD prevalence reduced from 79.7% at 18 to 24 months to 43.5% at 60 months. There were decreasing odds of OPD with increasing age (odds ratio [OR] = 0.92 [95% confidence interval (CI) 0.90 to 0.95]; P < .001) and increasing odds with poorer gross motor function (OR = 6.2 [95% CI 3.6 to 10.6]; P < .001). This reduction was significant for children with ambulatory CP (GMFCS I-II, OR = 0.93 [95% CI 0.90 to 0.96]; P < .001) but not significant for children from GMFCS III to V (OR [III] = 1.0 [95% CI 0.9 to 1.1]; P = .897; OR [IV-V] = 1.0 [95% CI 1.0 to 1.1]; P = .366). CONCLUSIONS: Half of the OPD present in children with CP between 18 and 24 months resolved by 60 months, with improvement most common in GMFCS I to II. To more accurately detect and target intervention at children with persisting OPD at 60 months, we suggest using a more conservative cut point of 6 out of 22 on the Dysphagia Disorders Survey for assessments between 18 and 48 months.

PMID: 29167377

10. Agreement between parents and clinicians on the communication function levels and relationship of classification systems of children with cerebral palsy.

Mutlu A, Kara ÖK, Livanelioğlu A, Karahan S, Alkan H, Yardımcı BN, Hidecker MJC.

Disabil Health J. 2017 Nov 14. pii: S1936-6574(17)30213-3. doi: 10.1016/j.dhjo.2017.11.001. [Epub ahead of print]

BACKGROUND: Functional classification systems have generally been used by clinicians and recently by parents to classify various functions of children with cerebral palsy (CP). OBJECTIVE: This study evaluated the agreement between clinicians and parents when classifying the communication function of children with CP using the Communication Function Classification System (CFCS). In addition, the relationships between the Gross Motor Function Classification System - Expanded and Revised (GMFCS-E&R), the Manual Ability Classification System (MACS), and CFCS were investigated.

METHODS: This study was a cross-sectional study and included 102 children aged 4-18 years with CP and their parents. The parents and clinician classified the communication of children by using the Turkish language version of CFCS. Furthermore GMFCS-E&R and MACS were used for classification only by the clinician. RESULTS: The weighted Kappa agreement between CFCS results of the parents and clinicians was 0.95 (95% CI 0.95-0.96, $p < 0.001$). GMFCS-E&R levels were highly correlated with CFCS levels ($r = 0.78$ (95%CI 0.68-0.84, $p < 0.001$)). MACS and CFCS results were also highly correlated ($r = 0.73$ (95%CI 0.63-0.81, $p < 0.001$). CONCLUSION: The child's communication was classified as indicating higher functioning by the parents compared with the clinicians. The excellent agreement between parents and clinicians with the Turkish language version of CFCS for children with CP indicated that parents and clinicians could use the same language while classifying the communication function of children.

PMID: 29162349

11. Reorganization of the somatosensory cortex in hemiplegic cerebral palsy associated with impaired sensory tracts.

Papadelis C, Butler EE, Rubenstein M, Sun L, Zollei L, Nimec D, Snyder B, Grant PE.

Neuroimage Clin. 2017 Oct 19;17:198-212. doi: 10.1016/j.nicl.2017.10.021. eCollection 2018.

Functional neuroimaging studies argue that sensory deficits in hemiplegic cerebral palsy (HCP) are related to deviant somatosensory processing in the ipsilesional primary somatosensory cortex (S1). A separate body of structural neuroimaging literature argues that these deficits are due to structural damage of the ascending sensory tracts (AST). The relationship between the functional and structural integrity of the somatosensory system and the sensory performance is largely unknown in HCP. To address this relationship, we combined findings from magnetoencephalography (MEG) and probabilistic diffusion tractography (PDT) in 10 children with HCP and 13 typically developing (TD) children. With MEG, we mapped the functionally active regions in the contralateral S1 during tactile stimulation of the thumb, middle, and little fingers of both hands. Using these MEG-defined functional active regions as regions of interest for PDT, we estimated the diffusion parameters of the AST. Somatosensory function was assessed via two-point discrimination tests. Our MEG data showed: (i) an abnormal somatotopic organization in all children with HCP in either one or both of their hemispheres; (ii) longer Euclidean distances between the digit maps in the S1 of children with HCP compared to TD children; (iii) suppressed gamma responses at early latencies for both hemispheres of children with HCP; and (iv) a positive correlation between the Euclidean distances and the sensory tests for the more affected hemisphere of children with HCP. Our MEG-guided PDT data showed: (i) higher mean and radian diffusivity of the AST in children with HCP; (ii) a positive correlation between the axial diffusivity of the AST with the sensory tests for the more affected hemisphere; and (iii) a negative correlation between the gamma power change and the AD of the AST for the MA hemisphere. Our findings associate for the first time bilateral cortical functional reorganization in the S1 of HCP children with abnormalities in the structural integrity of the AST, and correlate these abnormalities with behaviorally-assessed sensory deficits.

PMID: 29159037

12. Cerebral Palsy: An Overview.

Gulati S, Sondhi V.

Indian J Pediatr. 2017 Nov 20. doi: 10.1007/s12098-017-2475-1. [Epub ahead of print]

Cerebral palsy (CP) is a neurodevelopmental disorder characterized by abnormalities of muscle tone, movement and motor skills, and is attributed to injury to the developing brain. The clinical features of this entity evolve over time and the specific CP syndrome may be recognizable only after 3-5 y of age; although suggestive signs and symptoms may be present at an earlier age. The management involves neurological rehabilitation (addressing muscle tonal abnormalities, and devising physical and occupational therapies) and diagnosis and management of co-morbidities (including epilepsy, impairment of cognition, vision, hearing, and disturbances of growth and gastrointestinal function). The management, therefore, is multidisciplinary involving the treating physician working with a team of rehabilitation-, orthopedic-, psychologic-, and social care- providers.

PMID: 29152685

Prevention and Cure

13. Pretreatment with Human Chorionic Gonadotropin Protects the Neonatal Brain against the Effects of Hypoxic-Ischemic Injury.

Movsas TZ, Weiner RL, Greenberg MB, Holtzman DM, Galindo R.

Front Pediatr. 2017 Nov 3;5:232. doi: 10.3389/fped.2017.00232. eCollection 2017.

INTRODUCTION: Though the human fetus is exposed to placentally derived human chorionic gonadotropin (hCG) throughout gestation, the role of hCG on the fetal brain is unknown. Review of the available literature appears to indicate that groups of women with higher mean levels of hCG during pregnancy tend to have offspring with lower cerebral palsy (CP) risk. Given that newborn cerebral injury often precedes the development of CP, we aimed to determine whether hCG may protect against the neurodegenerative effects of neonatal brain injury. METHODS: We utilized the Rice-Vannucci model of neonatal cerebral hypoxia-ischemia (HI) in postnatal day 7 mice to examine whether intraperitoneal administration of hCG 15-18 h prior, 1 h after or immediately following HI decrease brain tissue loss 7 days after injury. We next studied whether hCG has pro-survival and trophic properties in neurons by exposing immature cortical and hippocampal neurons to hCG in vitro and examining neurite sprouting and neuronal survival prior and after glutamate receptor-mediated excitotoxic injury. RESULTS: We found that intraperitoneal injection of hCG 15 h prior to HI, but not at or 1 h after HI induction, resulted in a significant decrease in hippocampal and striatal tissue loss 7 days following brain injury. Furthermore, hCG reduced N-methyl-d-aspartate (NMDA)-mediated neuronal excitotoxicity in vitro when neurons were continuously exposed to this hormone for 10 days or when given at the time and following neuronal injury. In addition, continuous in vitro administration of hCG for 6-9 days increased neurite sprouting and basal neuronal survival as assessed by at least a 1-fold increase in MAP2 immunoreactivity and a 2.5-fold increase in NeuN + immunoreactivity. CONCLUSION: Our findings suggest that hCG can decrease HI-associated immature neural degeneration. The mechanism of action for this neuroprotective effect may partly involve inhibition of NMDA-dependent excitotoxic injury. This study supports the hypothesis that hCG during pregnancy has the potential for protecting the developing brain against HI, an important CP risk factor.

PMID: 29164084

14. White matter alterations and their associations with motor function in young adults born preterm with very low birth weight.

Hollund IMH, Olsen A, Skranes J, Brubakk AM, Håberg AK, Eikenes L, Evensen KAI.

Neuroimage Clin. 2017 Oct 4;17:241-250. doi: 10.1016/j.nicl.2017.10.006. eCollection 2018.

Very low birth weight (VLBW: ≤ 1500 g) individuals have an increased risk of white matter alterations and neurodevelopmental problems, including fine and gross motor problems. In this hospital-based follow-up study, the main aim was to examine white matter microstructure and its relationship to fine and gross motor function in 31 VLBW young adults without cerebral palsy compared with 31 term-born controls, at mean age 22.6 ± 0.7 years. The participants were examined with tests of fine and gross motor function (Trail Making Test-5: TMT-5, Grooved Pegboard, Triangle from Movement Assessment Battery for Children-2: MABC-2 and High-level Mobility Assessment Tool: HiMAT) and diffusion tensor imaging (DTI). Probabilistic tractography of motor pathways of the corticospinal tract (CST) and corpus callosum (CC) was performed. Fractional anisotropy (FA) was calculated in non-crossing (capsula interna in CST, body of CC) and crossing (centrum semiovale) fibre regions along the tracts and examined for group differences. Associations between motor test scores and FA in the CST and CC were investigated with linear regression. Tract-based spatial statistics (TBSS) was used to examine group differences in DTI metrics in all major white matter tracts. The VLBW group had lower scores on all motor tests compared with controls, however, only statistically significant for TMT-5. Based on tractography, FA in the VLBW group was lower in non-crossing fibre regions and higher in crossing fibre regions of the CST compared with controls. Within the VLBW group, poorer fine motor function was associated with higher FA in crossing fibre regions of the CST, and poorer bimanual coordination was additionally associated with lower FA in crossing fibre regions of the CC. Poorer gross motor function was associated with lower FA in crossing fibre regions of the CST and CC. There were no associations between motor function and FA in non-crossing fibre regions of the CST and CC within the VLBW group. In the TBSS analysis, the VLBW group had lower FA and higher mean diffusivity compared with controls in all major white matter tracts. The findings in this study may indicate that the associations between motor function and FA are caused by other tracts crossing the CST and CC, and/or by alterations in the periventricular white matter in the centrum semiovale. Some of the associations were in the opposite direction than hypothesized, thus higher FA does not always indicate better function. Furthermore, widespread white matter alterations in VLBW individuals persist into young adulthood.

PMID: 29159041