Universität Basel

Research Project

Muscle Function in Dynamic MRI in Patients with Cerebral Palsy Before and After Botulinum Toxin Injection

Third-party funded project

Project title Muscle Function in Dynamic MRI in Patients with Cerebral Palsy Before and After Botulinum Toxin Injection
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Muscle contractures are amongst the most frequently treated problems in children with cerebral palsy. They occur due to the aberrant muscle use under the neurological disorder and further impede function and daily activities. Foot equinus is one of the most frequent conditions, and treatment with injection of botulinum toxin has become a standard. In this study the functional properties of muscles - before and after the injection of botulinum toxin - in cerebral palsy patients will be assessed with a novel technique for the investigation of muscle function by MRI, based on synchronous electrical muscle stimulation (EMS). This approach provides information about muscle fibre length and angulation also in the active muscle, as well as contraction velocity and muscle strength. These data will be correlated with muscle pathology from needle biopsies and with gait function recorded by gait analysis. Synchronous EMS-MRI and gait analysis including dynamic superficial electromyography (EMG) will be applied three times to the patients: a) Before botulinum toxin injection, b) 6 weeks after botulinum toxin injection, and c) 3 months after botulinum toxin injection. Before botulinum toxin injection a needle biopsy of the selected muscle will be obtained from all patients. Muscle tissue is altered in cerebral palsy, and the biopsy provides the necessary histological data for understanding a possible atypical function before and after botulinum toxin injection assessed with EMS-induced MRI. For data comparison twelve healthy volunteers will be recruited whose data will serve as a normal reference. The volunteers will only obtain synchronous EMS-MRI and gait analysis including dynamic superficial EMG once. As we have histology data of normal muscles, biopsies and botulinum toxin injections are not required in these normal volunteers.The data of synchronous EMS-MRI from this study will be clinically relevant for several reasons:It may offer a non-invasive technique to obtain information on muscle pathophysiology in patients with cerebral palsy. A better knowledge of the function of the abnormal muscles during gait is essential for the adaptation of the current treatment options (e.g. less surgical lengthenings). It will further help to compute data from gait analysis more accurately as the parameters modifying the computations can be set according to the pathologies.Further, the information about the effect of botulinum toxin may help to explain some of the failures of current treatment procedures. It will be especially important to know how much of a muscle is affected and how the remaining part reacts. As a consequence of the study adaptations of the drug application may be required.

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