Physiological anatomy of botulinum toxin on the spastic muscle of children with cerebral palsy

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Objective Botulinum toxin is one of the treatments available to treat spasticity in patients with cerebral palsy (CP) from 2 years of age. The long-term action of the toxin on the neuromuscular junction (NMJ) and muscle structure is still unknown. We formulated the hypothesis that repeated injections of botulinum toxin could modify muscle structure. The main aim of our 3-year monocentric descriptive study is to evaluate the long-term effect of repeated injections of botulinum toxin on the muscle and the neuromuscular junction in patients with CP.

Material and methods Histopathological features and molecular biology were studied on muscle biopsies taken during scheduled orthopaedic surgeries. Evaluation criteria were the presence of fragmented neuromuscular junctions (both qualitative and quantitative) and axonal sprouting (qualitative).

Results Two muscle biopsies were performed in 2 children aged respectively 7 and 10 years. The biopsies were located respectively in the right gracilis (after 1 injection) and in the right sural triceps (after 3 injections). Histological features found were fragmented neuromuscular junctions (between 1 to 6), lack of axonal sprouting at the junction, the presence of CD56 satellite cells and presence of molecules suggesting the presence of denervated fibers. Whereas type I and type II fiber atrophy and fibrosis were found on the first biopsy, on the second were seen signs of atrophy of undifferentiated fibers without any sign of fibrosis. Additional results will be available soon.

Discussion/Conclusion This study should improve knowledge about the effects of long-term botulinum toxin on muscle (and therefore its safety in use) on the NMJ and on the physiopathology of the muscle of children with CP.

Keywords Toxin; Spastic neuromuscular junction; Cerebral palsy child
Disclosure of interest The authors declare that they have no competing interest.

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Effect of ankle-foot orthoses on gait in children with cerebral palsy: A meta-analysis

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Objective Different ankle-foot orthoses (AFO) are often prescribed in children with cerebral palsy (CP) although their efficiency on gait remains unclear.

Purpose (1) To determine the effect of AFOs on gait in children with CP and (2) to evaluate the effect of each types of AFO.

Material and methods Studies in English with control condition (barefoot or shoes) assessing effect of AFO about children with CP gait were search on the Pubmed, CINAHL+, Web of Science, Cochrane Library databases. Quality of each study was assessed by modified PEDRO scale. Only studies with a score more than 4 were selected. 10 gait parameters were extracted in each study.

Effect size and 95% confidence interval were calculated for each parameter.

Results Seventeen studies (490 subjects) were included. Comparing AFOs to control condition, stride length increased (15 studies) \( d = 1.04 \) [95% CI: 0.69; 1.38], velocity increased (16 studies) \( d = 0.27 \) [95% CI: 0.14; 0.41], cadence decreased (15 studies) \( d = -0.69 \) [95% CI: −0.95; −0.43], Ankle dorsiflexion increased at initial contact (11 studies) \( d = 1.64 \) [95% CI: 1.16; 2.11] and in swing phase (7 studies) \( d = 5.21 \) [95% CI: 1.91; 8.52]. Ankle power generation in stance phase decreased (6 studies) \( d = -0.26 \) [95% CI: −0.38; −0.14]. The duration of tibialis anterior activation and energy data did not changed significantly. Four types of orthosis were found: dynamic AFO, hinged AFO, solid AFO, supra-malleolar orthosis. Hinged AFO was the orthosis that improved the greater number of gait parameters and was the only one to improve velocity with an effect size > 0.8 (large effect).

Discussion/Conclusion This study shows clinically significant effect of AFO on stride length, ankle dorsiflexion at initial contact and swing phase. Hinged AFO seems to have the greatest effect on gait. New data are needed to refine the choice of the orthosis according to the child gait pattern.

Keywords Cerebral palsy; Ankle-foot orthosis; Gait
Meta-analysis
Disclosure of interest The authors declare that they have no competing interest.

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Relationship between hand function assessment and upper limb kinematic analysis in children with hemiplegic cerebral palsy

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