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Clinical decision making in spastic bilateral CP – Planning interventions using clinical gait analysis: A case study

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Research question: The aim of this case-study was to explain the use of clinical gait analysis in clinical decision making within the patient population of spastic bilateral CP. The study was to explore the possibilities of evaluating spasticity during functional situations with gait analysis to add some extra information to usual evaluation in supine.

Introduction: Cerebral Palsy (CP) is one of the most common neurological problems in childhood which often results in spasticity [1]. To help these children to achieve the best functional outcome, the intervention of interdisciplinary team (IDT) is necessary. The goal of the team is to find out the most problematic features which interfere in activities of daily living.

Materials and methods: 3D Vicon Gait Analysis System and two AMTI platforms were used to capture the data. Markers were placed according to Davis model. Physiotherapeutic assessment was carried out prior to the gait analysis. For interpretation 2 good gait trials from slow speed walking and 2 good trials from fast speed walking were selected. The patient was a 16-year-old girl, diagnosed with spastic bilateral CP. During the first trials she was asked to walk as good as she was able to, in order to achieve as typical gait pattern as possible. During the last trials she was asked to walk as fast as she was able to. The two gait patterns were compared to each other to find out what changes occurred. According to the findings clinical decisions were made and discussed within the IDT.

Results: Clinical gait analysis was conducted, interpreted and the results of interpretation were presented during the patient session of the IDT. Following points were brought out: changes in the ankle joint with the increase of gait velocity.

(i) plantarflexion at the initial contact increased, absent first rocker; (ii) throughout the midstance increased plantarflexion by 10 degrees; (iii) increased plantarflexion at terminal swing. Changes in the knee joint with the increase of gait velocity

(i) increased flexion at the initial contact and loading response; (ii) decreased and delayed peak flexion during swing; (iii) increased flexion at terminal swing.

The gait graphs were good illustrations for showing how spasticity increases with speed and alters the gait pattern adding valuable information about muscle work and effect of spasticity during function.

Discussion: Clinical gait analysis is an effective tool for assessment of spasticity during functional activities. It adds an extra value in making clinical decisions and treatment planning. In addition, gait analysis is a good illustrative tool for explanation of the effect of spasticity during walking to other IDT members.

Data from wireless EMG could be very useful for higher precision in detecting the muscles which contribute to various impairments during functional tasks.

Reference

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Session PS07 Pathology and Gait Interpretation

Size and length of the medial gastrocnemius and tendon in typically developing and cerebral palsy children

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Research question: Do the size and length of the gastro-achilles complex differ in typically developing (TD) and cerebral palsy (CP) children?

Introduction: Cerebral palsy is due to an insult in the infantile brain, leading to secondary changes in muscle structure. Such changes can be measured by ultrasound (US). By combining US images with a motion analysis system, a 3D reconstruction can be created [1]. Muscle volume and length are shown to differ in CP children [2], however, the evaluation method is cumbersome. We applied a new efficient approach to evaluate the size of the medial gastrocnemius (MG), and the length of the MG and tendon achilles (TA) in TD and CP children. We hypothesise that the new approach will detect a difference between the two groups.

Materials and methods: Seven CP and 7 TD children were recruited. With the child in prone lying, knee fixed and a resting ankle angle, images were acquired at 30Hz with US (Telemed, Lithuania), starting above the knee until the end of the calcaneus in a transverse orientation. To track the transducer, 4 rigidly attached reflective markers were captured by a motion analysis system (Optitrack, USA), at 120Hz. An in-house developed Python package [2] and Matlab (www.mathworks.de) were used for the 3D reconstruction and to compute volume and lengths. The latter were calculated between 3 landmarks: posterior surface of the medial femoral condyle, myo-tendinous junction and the distal point of the TA on the calcaneus. Average muscle area (=volume/muscle length) and normalised muscle volume (=volume/MTU length) were calculated. Comparisons were made using the Student’s t-test (unpaired).

Results: On average, muscle volume was smaller in the CP group (Table 1).

This was significant by comparing average muscle area and the normalized muscle volume (p = 0.018 and p = 0.040, respectively). No significant differences were found for the calculated lengths. In both groups, muscle volume had a significant linear relationship with age (R² > 0.79, p < 0.01), but with a lower slope in CP (5.2 vs. 7.8 cm²/years).

Discussion: As previously reported, we found a smaller muscle volume in CP children. It appears that calculating the muscle average area is more sensitive when making a distinction between TD and CP children. Interestingly, as a CP child ages, their muscle growth occurs at a slower rate than TD. Diagnosing muscle and

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References

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