Improving Understanding of Gait Analysis Data in Clinical Decision-Making: Using Muscle-Tendon Modeled Length and Velocity

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Introduction

Clinical usage of gait analysis is limited by multiple factors, including experience and expertise with gait analysis data²,⁶. At Alberta Children’s Hospital (ACH), understanding and communicating gait impairments involving two-joint muscles have been challenging to collaborative decision-making. A one-year pilot program using modelled muscle-tendon length and velocity (MTL&V) data (via OpenSim²) was introduced to improve the sharing of gait analysis results between gait analysis program staff and referring clinicians and physicians.

Program Design and Evaluation Methods

Define Opportunity

Build Understanding

Implement & Execute

Act to Improve

Sustain Results

How does the addition of MTL&V data affect clinical gait analysis in children with cerebral palsy at ACH?

Alberta Health Services Improvement Way (Design effort stream)

Evaluation Methods • Movement Assessment team and referring physicians/clinicians completed an online survey (response rate 57%). Group discussion (86% of invited participants attended) expanded on survey ideas. Thematic analysis of open-ended survey responses and transcribed group discussion was completed¹.

MTL Data Processing

Generic Model

Neutral Poses

Scaled Model

References

Muscle-Tendon Length

Muscle-Tendon Velocity

SAGITTAL

FRONTAL

TRANSVERSE

Joint Kinematics

Pre-intervention

Post-intervention

Results of Evaluation

Benefits

MTL adds an important reflection point when considering interventions to lengthen muscles.

MTL augments the physical assessment, encouraging consideration of functional versus static muscle length.

Visual nature of MTL&V data improves communication of multi-planar gait analysis results by presenting data in the form of specific muscles.

Challenges

Current lack of experience and expertise with MTL&V has limited usage for some practitioners and contributed to continued reliance on traditional assessment measures for decision-making.

Elements of clinical significance for MTL&V data remain unexplored, including influence of spasticity and/or walking aids on data.

Conclusions and Recommendations

For most clinicians, the addition of MTL data to clinical gait analyses at ACH provided a distinct benefit when considering interventions to lengthen muscles in children with cerebral palsy.

Continuation of the use of MTL&V data was recommended with additional evaluation in one years’ time.

Supplementary education sessions to aid in clinician understanding of MTL&V were recommended.

Additional local exploration of MTL&V data (in both typical and clinical populations) may impact integration of this knowledge into clinical practice.

MTL data may provide value in spasticity assessments and additional investigation is recommended.

REFERENCES


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Graph 1: Respondents’ Self-Rated Confidence in Elements of Clinical Gait Analysis

- Video gait observation
- Physical assessment
- Joint kinematics
- Joint kinetics and forces
- Muscle-tendon length
- Muscle-tendon velocity
- Gait indices

Not Confident at all: 0% | Very Confident: 41%

Self-identified expertise in overall clinical gait analysis did not appear directly linked to confidence in interpreting specific elements of clinical gait analysis.

Graph 2: Modeled Muscle-Tendon Length and Velocity

- Gait indices
- Bipedal stance
- Gait velocity
- Gait cycle
- Gait analysis
- Gait indices

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