GAIT ASYMMETRY IN CHILDREN WITH DOWN SYNDROME

**Bee-Oh Lim[1], Jae-Man Yoon[2], In-Sik Shin[3], Joong-Hyun Ryu[1],
Sung-Hoon Shin[1] and Young-Hoo Kwon[1]**
[1]Department of Kinesiology, Texas Woman's University, Denton, TX, U.S.A
[2] Department of Physical Education, Daegu University, Kyoungsan, Korea
[3]Department of Physical Education, Seoul National University, Seoul, Korea

KEY WORDS: down syndrome, gait, asymmetry

INTRODUCTION: It has been reported that approximately 80% of children with Down syndrome (DS) exhibit gait problems (Matteo, 2002), characterized by flat-footed contact with no heel-strike, excessive abduction of the leg in the swing phase, and abnormal knee and hip flexions throughout the gait cycle (Parker et al., 1986). Due to muscle hypotonia, muscle weakness, ligamentous laxity, and other orthopedic abnormalities, different gait characteristics exist. The purpose of this study was to investigate the gait (walking and running) asymmetry in children with DS.

METHODS: Five boys with DS (age: 12.0 ± 0.9 yrs; height: 134.9 ± 9.7 cm; mass: 34.4 ± 8.4 kg) participated in this study. A 10.0 m x 1.3 m walkway with a firm dark surface was built and used for data collection. Three-dimensional motion analyses were performed to obtain the stride length (% leg length), and the joint angles and range of motions. The vertical ground reaction forces (%BW) and impulses (%BW·s) were measured by two force plates embedded in the walkway. Asymmetry indices between the legs were computed for all

variables: $$AI = 2 \cdot \left| \frac{v_R - v_L}{v_R + v_L} \right|$$

where v = variable, R = right leg, and L = left leg.

RESULTS: The mean asymmetry index of select kinematic and ground reaction force variables ranged from 0.06 (knee flexion at initial contact) to 1.28 (max hip abduction) in walking and 0.03 (stride length) to 1.63 (max hip abduction) in running (Table 1). In conclusion, the max hip abduction angle exhibited more asymmetry in walking and running. Knee flexion angle at the initial contact and the stride length generally revealed the smallest asymmetry indices.

Table 1 Summary of the Asymmetry indices (Mean ± SD).

	Walking	Running
Max hip abduction (swing phase)	1.28 ± 0.50	1.63 ± 1.05
Hip flexion/extension ROM (swing phase)	0.36 ± 0.10	0.37 ± 0.32
Knee flexion/extension ROM (swing phase)	0.29 ± 0.17	0.19 ± 0.16
Knee flexion at initial contact	0.06 ± 0.05	0.06 ± 0.04
Ankle plantar flexion at initial contact	0.11 ± 0.01	0.13 ± 0.04
Stride length	0.07 ± 0.05	0.03 ± 0.03
First vertical peak force	0.16 ± 0.16	0.14 ± 0.19
Second vertical peak force	0.20 ± 0.21	N/A
Vertical impulse	0.25 ± 0.23	0.15 ± 0.19

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