Effect of Pelvic Kinematics on Spatio-temporal Parameters in People with Multiple Sclerosis

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Summary

Pelvic gait kinematics (PGKs) are impaired in people with multiple sclerosis (pwMS). This study aims to examine the effect of PGKs on spatio-temporal parameters (STPs) in pwMS. Twenty pwMS were included in this cross-sectional pilot study. Demographic and disease-related information of participants was recorded. Participants' PGKs and STPs were evaluated with the BTS® G-walk wearable internal sensor. Each participant walked a 10-meter walking path 6 times. The data obtained from 6 walks was average. A relationship was found between pelvic tilt and step length; between pelvic obliquity and speed, gait cycle duration, stride length, anterior propulsion, and gait symmetry; and between pelvic rotation and cadence, step length, and anterior propulsion ($p<0.05$). Consequently, PGKs are associated with STPs in pwMS. Therefore, PGKs should be considered in gait analysis and in determining rehabilitation goals in pwMS.

Introduction

Studies on pwMS have shown that PGKs are impaired compared to healthy subjects at even low EDSS scores [1, 2]. In a study examining the relationship between PGKs and the expanded disability status scale (EDSS) score, a positive relationship was found between the EDSS score and PGKs [3]. Additionally, PGKs were found to be associated with muscular functions and gait performance of pwMS [4]. Therefore, PGKs are important for gait performance and quality in multiple sclerosis (MS). However, no study has been found in the literature on the effect of PGKs on STPs during gait in pwMS.

Methods

Twenty pwMS were included in this cross-sectional pilot study. Demographic information, EDSS score, disease duration, number of attacks, and MS types were recorded. The participants' PGKs and STPs were evaluated with the BTS® G-walk wearable internal sensor and analyzed with the G-Studio® application. Each participant walked 6 times on a 10-meter walking path. The data from 6 walks were averaged and included in the analysis. Pelvic tilt, obliquity, and rotation symmetries and angles were evaluated as pelvic kinematics of the participants. Spatio-temporal parameters were the following: cadence, speed, gait cycle duration, stride length, step length, stance phase percentage, swing phase percentage, first double support time, single support time, anterior propulsion, and gait symmetry.

Results and Discussion

Demographic and disease-related data of 20 participants (14 female, 6 male) were as follows: Mean age 33±8.3; mean body mass index 23.8±4.32; mean disease duration 6±4.65; mean number of attacks 2.38±2.09. One participant had secondary progressive type MS; the other participants had relapsing-remitting type MS. Participants' EDSS scores were between 0 and 3.

The relationship between PGKs and STPs was examined statistically. Between pelvic tilt symmetry and step length, a significant relationship was found ($r=0.621$, $p=0.003$). A significant relationship was found between pelvic obliquity symmetry and speed ($r=0.736$, $p<0.001$), gait cycle duration ($r=0.667$, $p=0.001$), stride length ($r=0.555$, $p=0.01$), and gait symmetry ($r=0.869$, $p<0.001$). A significant relationship was found between pelvic obliquity angles and speed ($r=0.547$, $p=0.01$), gait cycle duration ($r=0.554$, $p=0.01$), anterior propulsion ($r=0.741$, $p<0.001$), and gait symmetry ($r=0.519$, $p=0.01$). Between pelvic rotation symmetry and cadence, a significant relationship was found ($r=0.450$, $p=0.04$). A significant relationship was found between pelvic rotation angles and step length ($r=0.561$, $p=0.01$), and anterior propulsion ($r=0.466$, $p=0.03$). No significant relationship was found between the other analyzed parameters ($p>0.05$).

Conclusions

The medium-high-level significant relationship between PGKs and STPs emphasizes the importance of pelvic kinematics in terms of gait in pwMS. Evaluation and determination of pelvic kinematics and its impairments, which are affected by EDSS, muscle functions, and performance, may enable a better understanding and treatment of gait disorders in pwMS. According to the findings, we underline that PGK is an important parameter for rehabilitation and gait analysis in pwMS.

References

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