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SPATIOTEMPORAL GAIT PARAMETERS AND GROUND REACTION FORCES IN STROKE SURVIVORS WITH DIABETIC PERIPHERAL NEUROPATHY

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ABSTRACT

The aim of this study is to investigate the changes of spatiotemporal gait parameters, gait variability, and ground reaction forces (GRFs) in stroke survivors with diabetic peripheral neuropathy (DPN). Ten stroke survivors with DPN (SDPN), 10 stroke survivors without DPN (S), and 10 healthy controls (HC) were participated in this case-control cross-sectional study. Spatiotemporal gait parameters, gait variability and GRFs were recorded using the Nexus Vicon motion analysis system. A total of 16 retro-reflective spherical markers were placed bilaterally on the certain anatomical landmarks and participants were asked to walk at a habitual speed within 5 meters of the platform. Raw marker data was collected using the camera motion analysis system were filtered at 10 Hz using a low-pass fourth-order Butterworth filter for data analysis. The Kruskal-Wallis test was used to analyse gait parameters, gait variability, and GRFs, and the Spearman's rank-order correlation coefficients test was used to identify the correlations between the muscle strength (Motricity Index (MI)), stroke severity (Stroke Rehabilitation Assessment of Movement (STREAM)), and functional balance (Berg Balance Scale (BBS)) variables with spatiotemporal gait parameters and GRFs. This study found that longer stride time (temporal gait parameter) instead of the shorter stride length (spatial gait parameter), greater gait variability, and slower cadence on the paretic and non-paretic side in SDPN compared to S and HC. This study also found significant alteration of medial-lateral forces of the non-paretic side and vertical forces of the paretic side in SDPN compared to other groups. In addition, there were smaller magnitude of anterior-posterior forces, medial-lateral forces, and vertical forces in SDPN compared to other groups. Gait parameters were significantly correlated with MI, STREAM, and BBS ($r = \pm 0.63 - 0.91$; $p < 0.05$) in SDPN. Gait parameters also were significantly correlated with BBS ($r = \pm 0.72 - 0.85$; $p < 0.05$) in S. These findings suggested that gait parameters, gait variability, and GRFs are affected in SDPN. Gait was further affected by impairments of the muscle strength, severity of stroke, and functional balance performance.

ACKNOWLEDGEMENT

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CHAPTER ONE

INTRODUCTION

1.1   BACKGROUND OF STUDY

The prevalence of diabetes mellitus (DM) is increasing as a worldwide pandemic. DM is a chronic disease that causes remarkable physical defect and fosters large socio-economic costs (Control & Prevention, 2011). Recently, an estimation of 382 million people in the world has diabetes with the majority are aged between 40 and 59 years old, and this number is expected to rise to 592 million by 2035 (Diabetes Atlas, 2013). Currently, the global prevalence of diabetes is estimated about 9% among adults aged 18+ years (World Health Organization, 2014a). In the United States, 208,000 people younger than 20 years old were diagnosed with DM in 2012, while, those older than 20 years were estimated to be about 28.9 million in the same year (Control & Prevention, 2014). In Malaysia, the prevalence of DM has increased tremendously from 11.6% in 2006 to 22.9% in 2013 including 12.1% of new diabetes (Wan Nazaimoon et al., 2013). In addition, it was projected that Malaysia is one of the top 10 countries with a high diabetes prevalence between 2010 and 2030 (Shaw, Sicree, & Zimmet, 2010).

Diabetes has become one of the economic health burdens in the global, as the increasing prevalence poses a great impact on the rapid rise of the health care cost. The United States invested USD 239 billion on diabetes that compromised 36% of global health expenditure (Control & Prevention, 2014). In Malaysia, it is reported that about USD 4,151.03 (RM 2,362.80) per inpatient is invested for diabetic foot care (Zawiah, 2007), while another USD 361.6 (RM 290.18) is spent per outpatient (Rohana, 2007). Therefore, drastic actions and serious efforts are required as diabetes has become one of the major burdens to the economy of Malaysia, beside negative impacts to the patient's quality of life (QoL).