UNIVERSITI TEKNOLOGI MARA

EFFECTS OF FUNCTIONAL ELECTRICAL STIMULATION- LEG CYCLING EXERCISE PLUS PROGRESSIVE RESISTANCE TRAINING ON LOWER LIMB MUSCLE STRENGTH AND VOLUME AMONG INDIVIDUALS WITH CHRONIC INCOMPLETE SPINAL CORD INJURY

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ABSTRACT

Spinal cord injury is a catastrophic event which leads to significant disabilities and change in an individual's lifestyle. It limits the ability to accomplish daily physical activities and engage in exercise, as well as the use of exercise equipment due to paralysis and environmental barriers. It has been widely established that exercise can improve the quality of life in individuals with SCI. One prominent method is the use of functional electrical stimulation-leg cycling exercise. To gain greater effects of exercise on the individual with SCI, it is recommended that they need to include resistance training. Thus, this study aimed to examine the effect of FES-LCE plus PRT on muscle strength and muscle volume among incomplete SCI. In this quasi-experimental study, 21 individuals with incomplete SCI were assigned into Control group and Intervention group (11 controls, 10 interventions) using purposive sampling. Intervention group received FES-LCE+PRT, while Control group received FES-LCE only. There were significant increased of isometric muscle peak torque on right and left quadriceps muscles, right and left hamstrings muscles, and left gastrocnemius muscles ($P < 0.001$) after 12 weeks training. In addition, for lower limb muscle volumes there were a significant increased in both right and left lower limbs. There was also significant good correlation in left hamstring muscle peak torque and muscle volume in 6 weeks ($r = 0.65$, $p = 0.03$) and 12 weeks ($r = 0.67$, $p = 0.04$). However, muscle strength and muscle volume shown no different between group. Therefore, training with FES-LCE plus PRT had no effect on muscle strength and muscle volume among individuals with incomplete SCI.

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CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

Spinal cord injury (SCI) is a catastrophic event which leads to significant disabilities and change in an individual's lifestyle (DeVivo, 2012). World Health Organization (WHO) reported that about 250,000-500,000 individuals suffer from SCI each year (World Health Organization, 2013). In the United States of America, new SCI cases have been estimated at 17,500 each year (*National Spinal Cord Injury Statistical Center*, 2017). In Malaysia, there is no available data on the incidence and prevalence of SCI. However, a single hospital epidemiology study by Ibrahim and colleagues reported that about 449 patients with spinal injuries were admitted to the spinal ward, in Hospital Kuala Lumpur between 2006 and 2009. The incidence of SCI remains high due to motor vehicle accidents (34.5%) and mostly involving individuals between the age group of 16 to 45 (Ibrahim et al., 2013). Lee and colleagues (2014) reported that in Asia the factors that contribute to the increased risk of motor vehicle accidents are multiple passengers, poor road infrastructure and overload transport. The other etiologies that can cause SCI are falls which commonly occur over 60 years of age, penetrating injuries such as gunshot wounds, and sports injuries (Lee, Cripps, Fitzharris, & Wing, 2014). Thus, based on these prevalence and incidence rate of SCI, it has cause for concerns, as it has enormous cost implications for health care services.

Disabilities resulting from SCI affect all aspects of life including physical, psychological and socioeconomic outcomes for individuals, as well as their family members. Furthermore, individuals with SCI also present with impairments such as bladder and bowel problems, musculoskeletal deformities and pressure ulcers (Gorgey & Gater, 2011). These justify the need for long-term treatment and rehabilitation interventions.

1.2 SCI and Its Consequences

The function of the spinal cord is to transmit neural impulses in motor and sensory tissues between the peripheral nerves and brain (Westcott, Rosa, & College, 2010). Since there is damage to the spinal cord, the transmission between the