

UNIVERSITI TEKNOLOGI MARA

**EFFECTS OF CONCURRENT TASK
ON GAIT AND POSTURAL
CONTROL PERFORMANCE IN
CHILDREN WITH TRAUMATIC
BRAIN INJURY**

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ABSTRACT

Background: Children with traumatic brain injury (TBI) have a wide range of cognitive and functional mobility impairment. Concurrent task refers to the secondary tasks that are performed simultaneously with the primary task (walking and standing). Walking and postural control under concurrent tasks may require greater attentional resource which could adversely affect their performance. Improper gait and postural control pattern during walking while performing concurrent task may contribute to fall in this population. **Objectives:** Thus, the purpose of this study was (1) to compare the effect of concurrent task on temporal-spatial gait parameters, (2) to compare the effect of concurrent task on postural control performance, and (3) to identify the dual-task cost (DTC) on gait parameters between TBI and typically developing (TD) children. **Methods:** Sixteen children with TBI (mean age 11.63 ± 1.89 years) and 22 TD controls (mean age 11.41 ± 2.24 years) participated in this case-control study design. Each participant performed straight walking and upright standing under three different conditions: single, concurrent motor, and concurrent cognitive task. Gait parameters included gait velocity, stride length, stride time, cadence, and double support time. While postural control performance measure includes sway area, anterior-posterior (AP) sway velocity, medio-lateral (ML) sway velocity, AP sway distance and ML sway distance. These parameters and performances were measured using the APDM® Mobility Lab. In addition, DTC for each gait parameter was calculated using specific formula. A descriptive analysis and repeated-measure analysis of variance (ANOVA) were used to analyze the data. **Results:** Children with TBI showed more significant deterioration in gait performance than TD children ($p < 0.05$). Concurrent tasks (motor and cognitive) significantly decreased gait velocity and cadence, while stride time increased and differences were more discerned under concurrent cognitive task. Similar to postural control performance, children with TBI showed more significant decrement than TD children ($p < 0.05$). Both concurrent tasks (motor and cognitive) significantly decreased postural control performance in both groups with more pronounced changes in children with TBI than TD controls. As for DTC, children with TBI had higher negative DTC in all gait parameters compared to TD control which indicated case group had more interference and deterioration of walking performance under concurrent task conditions. Both concurrent tasks (motor and cognitive) led to the deterioration of walking performance in all parameters evidenced by negative DTC in both groups. **Conclusion:** The findings of this study demonstrated performing concurrent tasks (motor and cognitive) while walking and upright standing resulted in deterioration of both performance. Both gait and postural control performance may be affected by task complexity following TBI. The existence of cognitive and balance impairment in children with TBI will possibly cause concurrent tasks to be more complex and demands greater attention compared to a single task. This study also has clinical implications for assessment and rehabilitation in children with TBI. The ability to execute concurrent tasks in this population is crucial to ensure safety during walking and postural control, especially in outdoor settings. Thus, it is recommended that routine rehabilitation intervention for children with TBI should incorporate concurrent task for gait and postural control to augment and achieve optimal functional performance.

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CHAPTER ONE

INTRODUCTION

1.1 Research Background

Traumatic brain injury (TBI) is one of the leading causes of mortality and morbidity in the world. According to World Health Organization (WHO), TBI will exceed many diseases as a critical health condition and public health concerns by the year 2020. The impact of TBI varies according to the severity of the injury and the affected part of the brain involved. The consequences of TBI include sensorimotor impairment, cognitive deficit and the behavioral changes (Backeljauw & Kurowski, 2014). Moreover, the lifelong outcome of TBI usually affects more on cognitive and psychosocial interference as compared to motor disabilities (Beretta et al., 2009). The complex complication and increasing number of TBI survivors added a burden for the long-term outcome not only for the patient but also to relative, community and healthcare management (Liew, Johari, Nasser, & Abdullah, 2009; Puvanachandra & Hyder, 2009).

Management for individual with TBI required high-cost expenditure especially from a medical aspect as most of them need further treatment and visit to the hospital. Thus, it has been a tremendous financial burden to the country like Malaysia as a developing country (Liew et al., 2009). The mismatch of large number of severe TBI patients with limited numbers of bed available in intensive care unit (ICU) and inadequate numbers of neurosurgical ICU in Malaysia will be a significant issue that needs a proper management (Liew et al., 2009). Based on the study in the United States (US) revealed the lifetime costs of TBI estimated \$60 billion each year which cover both medical cost and lost productivity (Langlois, Rutland-brown, & Wald, 2006). Therefore, family member, the medical team, public health, and community must work together to alleviate the burden and to ensure a better future for individual with TBI.

1.1.1 Definition and Classification of TBI

According to Center for Disease Control and Prevention (CDC), TBI can be defined as injury occur due to bump, blow or jolt to the head or a penetrating head injury that disrupts the normal function of the brain (Faul, Wald & Coronado, 2010). It can be