

History of the Dual-Task Training in Children with or without Disabilities in the Post World War Era: A Brief Review

Asir John Samuel*, John Solomon**, Divya Mohan***

*Assistant Professor, Maharishi Markandeshwar Institute of Physiotherapy and Rehabilitation, Maharishi Markandeshwar University, Mullana-133207. Haryana. India. **Professor, Department of physiotherapy, School of Allied Health Sciences, Manipal university, Manipal, Udipi, Karnataka.***Associate Professor, Department of physiotherapy, School of Allied Health Sciences, Manipal Hospital, Manipal university, Bangalore, Karnataka

Abstract

Dual-task Training (DTT) is an activity in which a person performs two attentional demanding tasks simultaneously. Many researchers have demonstrated the effectiveness of DTT in rehabilitation of persons with Parkinson's disease (PD), traumatic brain injury and other neurological conditions among adult populations. But DTT has not been explored in children with and without disabilities in the post World War Era (WWE). Hence, we present here the brief review on the history of DTT from the searched online database such as Google Scholar, OvidSP, Cochrane review, PubMed and PEDro from 1945 to 2010. This review will be a short history of DDT in post WWE.

Keywords: Cognitive Rehabilitation; Dual-Task; Postural Task; Review; Theory.

Introduction

Difficulty to maintain balance while performing more than one task has been found in individuals with various types of nervous system pathology. Postural stability declines during the concurrent performance of cognitive task and physical task such as maintaining standing balance. They exhibit greater postural sway and on the greater risk of fall. This could be overcome by the dual-task training (DTT). DTT is a rehabilitation procedure in which an individual performs two attentional demanding tasks simultaneously. The relationship between cognitive function and postural control are being studied by many researchers. This review would elaborate the history of the research done in post World War era in children with or without disabilities.

Dual-task paradigm

Several researchers have used the dual-task

paradigm to study the attentional demands of maintaining an upright posture and they have chosen postural control task as primary task. Theorists have long attempted to explain the influence of attention on performance by Limited capacity theory and Selection for action theory in the past 50 years [1].

Limited capacity theory

According to Limited capacity theory (1950-1980), theorists postulated that the human brain is capable of processing only a certain amount of information at a particular point of time [1]. Thus a person's performance is not adversely affected when a concurrent task is performed within the brain's available capacity. Dual-task interference occurs when the requirements for a certain task exceed the brain's capacity and a process of selective attention is in place as a means of allocating available resources under multitask conditions. But these theories were later shown to be inadequate and limited in their ability to predict postural behavior

Corresponding Author: Asir John Samuel, Assistant Professor, Maharishi Markandeshwar Institute of Physiotherapy and Rehabilitation, Maharishi Markandeshwar University, Mullana-133207. Haryana. India.
E-mail: asirjohnsamuel@mmumullana.org, asirjohnsamuel@gmail.com

under dual-task conditions [2] and so lost their popularity.

Selection for action theory

A new theory known as Selection for action has emerged since 1980s. If two conflicting tasks are being performed simultaneously then those conditions are either modified so task can be performed or one of the task is postponed or not completed [3]. From this concept Neumann claims that the dual-task are performed concurrently using action planning where two tasks are combined into one higher order skill. Pellecchia offers support for this concept by her study. By a dual-task methodology, the researcher showed that postural sway increased with increasing attentional demands of concurrent cognitive task, with most difficult cognitive task having the greater influence on sway [4].

Dual-task in children

Researchers have focused on developmental changes in the ability to simultaneously perform various cognitive and motor tasks. In studies such as verbal-manual time sharing, both concurrent tasks have involved a motor component. For example, children have been asked to recite tongue twisters or animal names while concurrently performing manual skills such as finger tapping [5]. More complex motor skills and cognitive task combinations have used in other studies [6, 7].

Postural task and cognitive task

When dual-task methodology is used to investigate the effects of divided attention, subjects typically are instructed to give equal priority to primary and secondary task performance. Kerr and colleagues performed the first research to demonstrate attentional demands of stance postural control. Several researchers have chosen postural control tasks as primary tasks [8-11]. But all of them have focused on older adults neurological patients. Pellecchia is the pioneer in this area. She reported that postural sway increases with attentional demands of concurrent cognitive task [4]. The purpose of her study was to determine whether postural sway varied with the difficulty of a concurrent unrelated cognitive task. Participants stood on a compliant surface under four conditions of varied attentional demand. Information reduction tasks such as digit reversal, digit classification, counting backward by 3s were used to quantify the attentional demands of the cognitive activity. Results

showed attentional demands of the cognitive task impacted postural sway, with the most difficult cognitive task having the greatest influence.

Dual-task training

She examined the hypothesis that following DTT, a concurrent cognitive task would not amplify postural sway. Participants ($N = 18$) were assigned to no-training, single-task training, or dual-task training groups. Single-task training consisted of 3 sessions in which the postural task, quiet standing on a compliant surface, and the cognitive task, counting backward by 3s, were practiced separately. DTT consisted of 3 sessions of concurrent practice of the cognitive and postural tasks. After training, performance of a concurrent cognitive task increased postural sway in the no-training and single-task training groups but not in DTT group. Results suggest that dual-task practice improves dual-task performance [1].

Recent field of interest

Blanchard along with Pellecchia were first to test the interaction between the cognitive process and motor control in pediatric population [1]. She studied the influence of concurrent cognitive tasks on postural sway in children. 19 fourth-grade students, while standing on a balance platform, were asked to stand still, count backward, and read second-grade level sentences. The AMTI Accusway System was used to calculate the length of center of pressure path (LCOP), sway range (SR), and sway variability (SV) in mediolateral (ML) and anteroposterior (AP) directions of sway. The demands of concurrent cognitive tasks while standing affect postural sway in children. The findings of their study contribute to our understanding of postural control in children and may explain why improvements in postural skills attained in clinical settings may not transfer to improved performance in other settings [1]. From then, researchers began to explore their areas of interest in pediatrics. Cerebral palsy is a field of interest for most of the recent researchers [12].

Conclusion

There is a vast development in pediatric rehabilitation using DTT in post WWE. But still there is a long way to go. More research have to be performed in pediatric conditions such as Down's syndrome, cerebral palsy, muscular dystrophy,

infantile hemiplegia, etc., using DTT. There is a lack of systematic reviews and high quality randomised controlled trials (RCT) to add high level of evidence in pediatric rehabilitation.

Conflict of Interest: None declared

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