



Motor Control and Learning for Motor Recovery and Rehabilitation

John SY Chan and Jin H Yan*

Department of Laboratory of Neuromotor Control and Learning, Shenzhen University, China

Editorial

Traditionally, motor control is defined as the way our central nervous system produces purposeful and coordinated movements to achieve certain goals, and motor learning is the process to acquire and automatize a motor skill through practice [1]. Motor control and learning can be described of the movement mechanisms and change of movement proficiency in response to training or novel experiences through multidisciplinary approaches.

Injuries and neurodegenerative diseases, such as Parkinson's disease, can incur degradation of motor functions and mobility, which in turn reduces one's participation in health promoting activities, like sports. Medication only partially normalizes motor deficits, and one has to take some rehabilitative efforts to regain or to re-adjust the skills once affected. Thus, appropriate organization and implementation of rehabilitation programs can contribute significantly to one's recovery of motor skills.

Principles of motor control and learning can offer guidelines and insights into the development of efficacious rehabilitation programs to cater individual needs. Humans can be considered an information processing system with limited cognitive resources (particularly in memory and attention) [2]. Successful rehabilitation programs should fully utilize one's processing capability without overwhelming it. It is commonplace that students are asked to focus on the task they are doing. This works well most of the time; however, when task becomes more complicated, directing attention to the task can be detrimental to motor performance [3]. Instead, directing attention away from the task prompts more natural movements and benefits learning subsequently. In elderly people, due to their reduced memory span, it would be difficult for them to associate their motor performance with feedback when the interval between movement and feedback delivery is long [4]. This shows that task demand should not go far beyond one's psychological limitations.

Furthermore, motor control and learning theories put considerable emphasis on differences between individuals and skill characteristics. For instance, people in different developmental stages may perceive the difficulty of an identical task differently. For learning to juggle, breaking the movement sequence into smaller parts to practice is more beneficial for young children while practicing the whole movement sequence at a time is better for older children [5]. In addition, the effectiveness of training may depend on skill characteristics. Distributed practice generally produces better learning outcomes than massed practice. However, the two types of practice schedule lead to similar outcome when it comes to tasks of high complexity and high mental requirements [6]. It is suggested that a comprehensive assessment of learner and task characteristics are essential for achieving optimal training outcomes.

Technological advancements and development of sophisticated tools in recent years enable researchers to have a better understanding of the mechanisms underlying motor rehabilitation. Nowadays, neuroimaging is extensively used to unravel the neural underpinnings of skill acquisition and impact rehabilitation programs. The findings that act on observation and execution share high resemblance in brain activity have motivated the application of motor imagery in patients in vegetative states for rehabilitative purposes [7]. Moreover, applications of electrical or magnetic stimulation to regions critical for motor functions seem to enhance motor learning and its efficacy on clinical populations remain to be investigated [8].

In conclusion, an application of knowledge of motor control and learning will continue to contribute to the improvement of motor recovery and rehabilitation. The recent technological advancements will bring better insights into the mechanisms of motor rehabilitation and assist in the development of tools to improve rehabilitation efficacy.

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*Correspondence:

Jin H Yan, Department of Laboratory of Neuromotor Control and Learning, Shenzhen University, Shenzhen, 518060, P.R. China, Tel: 86-0755-8617-2023;

E-mail: jhyan@sfsu.edu

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