Chapter 3
Neurological Disorders, Rehabilitation, and Associated Technologies:
An Overview

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ABSTRACT

Patients with neurological disorders are increasing globally due to various factors such as change in lifestyle patterns, professional and personal stress, small nuclear families, etc. Neurological rehabilitation is an area focused by the several research and development organizations and scientists from different disciplines to invent new and advanced rehabilitation devices. This chapter starts with the classification of different neurological disorders and their potential causes. The rehabilitation devices available globally for neurological patients with their underlying associated technologies are explained in the chapter. Towards the end of the chapter, the reader can acquire the fundamental knowledge about the different neurological disorders and the mal-functionality associated with the corresponding organs. The utilization of advanced technologies such as artificial intelligence, machine learning, and deep learning by researchers to fabricate neuro rehabilitation devices to improve patients' quality of life (QOL) are discussed in concluding section of the chapter.

INTRODUCTION

In human's, disease or injury due to nervous system is treated as neurological disorder. The malfunction of either central or peripheral nerves system due to biochemical, electrical or structural abnormalities can cause neurological disorders. The neurological disorders are categorized as movement, sensory and mental. Abnormalities in the central nervous system will affect the functionality of brain and spinal-cord.

The functionality of hands, legs and other sensory organs are depending on performance of peripheral nervous system. Rehabilitation to neurological patient depends on kind of neurological disorder, age, gender, living atmosphere and life style. Based on situation and purpose the rehabilitation devices are helpful for physiotherapist and nurses to make their task easy and reduces the burden on patient. The rehabilitation device will play the role for neurological patient throughout their life-spam. The advanced technology such as artificial intelligence, machine-learning and deep-learning in the field of computer science and robotics facilitate the bio medical engineer to design multipurpose devices rather than single application oriented devices and size of the devices are tremendously decreased which lead to easy transportation. New physiotherapy techniques are discovered based on the advanced technology. Irrespective of the technology, the purpose of any rehabilitation device is to facilitate the user to do their daily activities by themselves without any risk. However, independent of technology used each device has its own merits and demerits. The objective of this chapter is to provide fundamental knowledge of different neurological disorders and classification. The working principle and associated technology, along with merits and demerits of various rehabilitation devices and therapy techniques are briefly explained. The future scope of the current technology in neuro-rehabilitation engineering is discussed in the concluding section of this chapter.

NEUROLOGICAL DISORDERS AND CLASSIFICATION

Based on the literature survey it can be concluded that humans are suffering from more than 600 types known neurological disorders. According to the Global Burden of Diseases (GBD) Neurological disorders are the leading cause for disability and sometimes lead to death. Feigin et al gave the brief summary on global, regional and national wide burden of neurological disorders for the period from 1996 to 2015 (Headache, dizziness, raised intracranial pressure, unconsciousness, Neurological problems and Neurological disorders). The international classification of functioning, disability and health (ICF) provides the description of health and related states. In order to design best or innovative rehabilitation device/ therapy, the designer must possess the basic knowledge of various neurological disorders, causes and effects on performance of the organs. Any neurological disorder can cause impairment in movement, sensory and mental. The classification of the neurological disorder based on the nature of impairment is shown in table 1.

REHABILITATION FOR NEUROLOGICAL DISORDERS

Rehabilitation services provide help to improve the abilities against the impairment of disabled people and not focus on the disease. The impairment may have related to consciousness, cognition, speech, vision, sensory and physical movement. The level of impairment depends on the neurologic function across multiple domains. The various scales such as Glasgow Coma Scale and American Spinal Injury Association Impairment are used to evaluate patient's condition. The patient's ability to perform their routine tasks are measured in terms of daily living activities and functional independence measure. Rehabilitation will be achieved through learning compensatory techniques and adaptation to promote neurological recovery. Over the past two decades' tremendous growth in neuro rehabilitation technologies such as robotic systems, electrical stimulators and wearable sensors to check the actual performance.

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