



## Effectiveness of robo-assisted lower limb rehabilitation for spastic patients: A systematic review



Divya Shakti<sup>a,\*</sup>, Lini Mathew<sup>a</sup>, Neelesh Kumar<sup>b</sup>, Chitra Kataria<sup>c</sup>

<sup>a</sup> Department of Electrical Engineering, National Institute of Technical Teachers' Training and Research, Chandigarh, India

<sup>b</sup> Biomedical, Instrumentation Division, Central Scientific Instruments Organization, Chandigarh, India

<sup>c</sup> Department of Rehabilitation Services, Indian Spinal Injuries Centre, New Delhi, India

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### ABSTRACT

**Background:** Though many rehabilitative treatments are available for treatment of spasticity, thus the effectiveness of different robo-rehabilitative devices needs to be evaluated through a systematic review.

**Objective:** The objective of this study is to focus on the efficacy of Robot assistive rehabilitation device for the removal of spasticity from the lower limb of Spastic patients.

**Data Sources:** PubMed, Web of Sciences, EMBASE (Excerpta Medica database), CDSR (Cochrane database of systematic reviews), Scopus, IEEE Xplore, Wiley online library, MEDLINE (OvidSP), Science Direct, Springer Link were from January 1980 to September 2017

**Data Extraction:** Seventy-one publications from eleven databases published were selected using keywords Ankle foot, spasticity, robotic rehabilitation, efficacy of robotics and Ankle foot rehabilitation. The review is narrowed down to twenty-six articles which were selected for they focused on effects of Robot assistive rehabilitation device quantitatively.

**Result:** A quantitative study from analyzing 26 studies comprising of 786 subjects is carried out. The major outcome of the effectiveness of the robot assistive therapy for the movement of ankle and functioning of gait is deduced. As the used protocols and treatment procedures vary, made comparative study complex or impracticable.

**Conclusion:** Robo-rehabilitation possesses an ability to provide unified therapy protocols with greater ease in comparison to conventional therapies. They continuously prove to be irreplaceable assistant devices when it comes to providing excellent treatment in terms of improvement from this study. Though many mechatronic devices are available but the devices for treatment of early stage rehabilitation of stroke patients is very limited.

### 1. Introduction

Spasticity is a condition in which there is a continuous contraction of muscle resulting in inability to control the muscle. Generally, occurrence of Spasticity is due to disorders of the CNS which are affecting the motor neurons. Spasticity occurs when there is an imbalance in the excitatory and inhibitory input signal which is caused due to injury of spinal cord and CNS including stroke.

Spasticity occurs due to disorders of the CNS affecting the motor neuron and it has affected more than 12 million people worldwide. About 4/5 of patients suffering with cerebral palsy (CP) and multiple sclerosis have varying degree of spasticity. Spasticity also occurs in the state when the brain and/or spinal cord fail to develop normally or are damaged and it may include Traumatic Brain Injury (TBI), Brain damage due to insufficient oxygen, Spinal cord injury (SCI), Meningitis

and Stroke (Bose et al., 2015).

Due to stroke, there is an alteration in the net inhibition and excitation required in the affected region. This results in the increased depolarized state of neuron cell membrane (Hui et al., 2015). So, the threshold of action potential of neuron decreases which result in immobilized spastic muscle. According to WHO, Stroke is the “rapid developing clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 h or longer or leading to death, with no apparent cause other than of vascular origin” (Guilbert, 2003).

Today stroke is the major reason for disability in adults in Western Countries (Carolei et al., 2002), and the most common cause of death in the world (World Health Organization, 2008) and in this 80% are first event and rest are relapses. The report also states the data of some European countries. Italy has annual stroke incidence of approx. 200,000 patients and it is the third major cause of death behind

\* Corresponding author.

E-mail address: [goeldiviyashakti@gmail.com](mailto:goeldiviyashakti@gmail.com) (D. Shakti).