

# Clinical and Electromechanical Methods of Spasticity Assessment: A Review

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## ABSTRACT

Spasticity is a neurological disorder which results in disordered sensorimotor control owing to an upper motor neuron lesion. The muscles are continuously contracted which causes stiffness in the muscle which hinders the movement of muscle from their natural movement. It is mainly caused due to an injury to the central nervous system. Commonly used assessment methods of spasticity like the Ashworth and modified Ashworth scales do not quantify the degree of spasticity in the patients as they simply make available a semi quantitative degree of the force applied by the foot as resistance to passive movement with restricted inter-rater reliability. Electromechanical methods like isokinetic dynamometers can be used only when an objective quantitative weigh is available for the resistance to passive motion. Electrophysiological methods are valuable for the understanding of the pathophysiological procedures tangled in spasticity. But none of the methods are easy and reliable.

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## 1. Introduction

One of the most common diseases which potentially disables the person is Spasticity which affects the Spinal Cord Lesion (SCL) of the individual. According to studies 70% SCL patients end up having spasticity within one year of injury<sup>1</sup> and the anti-spastic medication is so scarce that only half receives them<sup>2</sup>. For having an effective treatment and validations of possible effects of new treatment inventions quantitative assessment of spasticity and spasms have to be done. Spasticity, though, easy to recognize but is not easy for its quantification. The main aim of this review paper is an evaluation of the reliability of the commonly used procedures for the spasticity quantification. Also, it determines the relationship between the tests used in the clinic which are generally done manually and more objective and quantifiable neurophysiological and electrophysiological techniques generally used for further investigation. To determine the positive potential effects of new treatment inventions a quantitative assessment of spasticity and spasms has to be done. Although spasticity is generally easy to recognize, it is not the same in terms of its quantification. Therefore, the main purpose of this paper is an assessment of the most frequently used methods for their reliability and quantification.

The distinguishing feature between the spasticity and other syndromes where there is a change in resistance to passive movement is its velocity dependency. The main problems with stiffness, fibrosis, contractures and atrophy change the muscle mechanical properties and also their classification and definition found in patients with SCL<sup>3</sup>. A significant relation between contracture and spasticity is the reduced range of motion (ROM)<sup>4</sup>. These changes distinguish them from spasticity but their determination is very difficult clinically. The distinction is of great significance as it determines the drugs to be given as well as the anti-spastic therapy to be given. SCL suffering patients have less severity

of spasticity as compared to those with nominal sparing of voluntary movement<sup>1,2,4</sup>. The degree of spasticity ranges from trivial to serious disabilities. Variation in spasticity during the day time it termed as cervical SCL<sup>5</sup>.

## 2. Clinical Methods

Clinical methods provide the quantitative and semi-quantitative measure of the resistance to passive motion. Various clinical methods have evolved over the time. Some clinical methods are discussed are Ashworth Scale, Modified Ashworth Scale, Tardieu Scale, Modified Tardieu Scale, Pendulum Test, Spasm Frequency Scales, Mynometric Devices, Neurophysiological, Electromechanical techniques as shown in Fig. 1.

### 2.1 The Ashworth and Modified Ashworth scales

The most often used procedures for the assessment of spasticity and its estimation are the Ashworth Scale (AS) and Modified Ashworth Scale (MAS). The simplicity of AS and no instrument requirement makes it a quick and easy method to carry out in numerous research studies. Bohannon and Smith established that a scale to the lower end to be added as several of their patients manifested that level of spasticity<sup>6</sup>. To make the scale less discrete, they included an extra category and they modified the scale. During the research, the rater should have an adequate training of the rating procedure before beginning the testing procedure and a well-designated procedure should be followed by the rater. Because of the large variation in the rater, it is suggested that only one rater should accomplish the entire test in an examination. For determination of all the influences from passive muscle structure, the operation of the limb at a speed should be done under the threshold of stretch reflex activity and the comparison should be done between the resistance at this speed and the higher speed of movements.