

ABSTRACT

Evaluation of an electromechanical oscillatory device for the assessment of the neural and non-neural components of wrist hyper-resistance in patients with central nervous system disorders.

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Introduction

In central nervous system diseases, joint hyper-resistance presents neural (CNS related) and non-neural (tissue related) components. Its assessment remains mostly clinical, and there is a need for new objective methods to evaluate it.

Methods

An electromechanical oscillatory device was designed to evaluate wrist stiffness (Wrist-EOD). It applies low amplitude sinusoidal wrist displacements in flexion and extension (10°), at frequencies between 3 and 12 Hertz. This produces a torque response that can be decomposed in viscous and elastic stiffness (Fourier analysis). The paretic and healthy upper limbs of twenty-two stroke patients were evaluated three times with the Wrist-EOD, to assess short and long-term reliability. Clinical and isokinetic (Cybex®) measurements of hyper-resistance were also performed. The Wrist-EOD was also performed in 12 stroke patients, before and after applying shock wave therapy (SWT) on wrist and fingers flexors, to assess its responsiveness to a spasticity treatment.

Results

Scores for viscous stiffness were significantly higher in comparison to the healthy wrist scores ($p=0.008$). The short-term ICC for elastic stiffness (0.91) and viscous stiffness (0.95) was excellent. The long-term reliability was moderate (ICC: 0.60 and 0.68). However, only poor correlations were found with clinical or isokinetic measurements. Wrist-EOD scores were significantly more reliable than isokinetic measurements. A significant decrease in spasticity was observed immediately after SWT in the wrist and fingers flexors ($p=0.022$ and 0.048 , respectively). No significant difference was observed with Wrist-EOD.

Conclusion

The Wrist-EOD is a reliable and discriminative device to measure stiffness of the wrist, enabling to assess mostly non-neural component of hyper-resistance.