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Design and Construction of a Device to Facilitate the Stretching of a Plantiflexors Muscles in the Therapy of Rehabilitation for Patients with Spastic Hemiplegia

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Abstract : Spasticity in the plantiflexor muscles as a product of stroke (CVA-Cerebrovascular accident) restricts the mobility and independence of the affected people. Commonly, physiotherapists are in charge of manually performing the rehabilitation therapy known as Sustained Mechanical Stretching, rotating the affected foot of the patient in the sagittal plane. However, this causes a physical wear on the professional because it is a fatiguing movement. In this article, a mechanical device is developed to implement this rehabilitation therapy more efficiently. The device consists of a worm-crown mechanism that is driven by a crank to gradually rotate a platform in the sagittal plane of the affected foot, in order to achieve dorsiflexion. The device has a range of sagittal rotation up to 150° and has velcro located on the footplate that secures the foot. The design of this device was modeled by using CAD software and was checked structurally with a general purpose finite element software to be sure that the device is safe for human use. As a measurement system, a goniometer is used in the lateral part of the device and load cells are used to measure the force in order to determine the opposing torque exerted by the muscle. Load cells sensitivity is 1.8 ± 0.002 and has a repeatability of 0.03. Validation of the effectiveness of the device is measured by reducing the opposition torque and increasing mobility for a given patient. In this way, with a more efficient therapy, an improvement in the recovery of the patient's mobility and therefore in their quality of life can be achieved.

Keywords : biomechanics, mechanical device, plantiflexor muscles, rehabilitation, spastic hemiplegia, sustained mechanical stretching
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