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Relationship between the time spent in double support phase of gait and the knee strength in subjects with stroke.

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The double support phase (DS), which commences at initial heel contact and lasts for throughout the loading period is a determinant of gait efficiency [1]. In subjects with stroke, the knee control tends to be modified during the DS [2] but the mechanisms involved on its impairment are not fully understood. The knee control is complex and depends on several factors such as the knee strength (KS). The KS role on the knee control during DS is still unknown [3]. This study therefore aims to explore the relationship between KS and the time subjects with stroke spent in DS.
Subjects less than 3 months post-stroke, able to walk independently or with human assistance, were recruited from Convalescence Units of three hospitals in Portugal. The time spent in DS was assessed using video taken in the sagittal plane whilst patients walked along a 5 meter corridor at their preferred speed. Rectus Femoris (RF) and Biceps Femoris (BF) maximal isometric muscle strength were assessed using a hand held dynamometer (MICROFET, Hoogan Ind.). Three trials were performed for each parameter (DS time and RF and BF isometric strength). Descriptive statistics and Spearman's correlation were used for data analysis. Eighteen subjects (7 women and 11 men aged 67±12.9 years old and overweight - BMI=25.46±2.58) enrolled in the study. They presented a BF strength of 5.05±0.32(Kgf) and a RF strength of 7.04±0.41(Kgf); 30.14%±6.44 of the gait cycle corresponded to the DS, which is three times than the expected results in healthy subjects. The time spent in DS was negatively correlated with isometric RF strength (-0.651; p=0.003) but no relationship with BF strength was seen. Therefore, during the acute period of stroke recovery, the weakness of RF could be a determinant factor for the increased time spent in DS phase. Improving RF isometric strength may be an important factor for post-stroke gait rehabilitation.

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A new device using EMG signals for upper limb treatment in patients with stroke: a proof of concept study

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Background
Only 5% to 20% of hemiplegic stroke patients demonstrate complete functional recovery of the paretic arm. Therapy should comprise intensive repetitive movements in which the patient is actively involved. In this context, robotic devices offer a unique training approach that may enhance motor outcomes beyond what is possible with conventional motor therapy.
Methods
This proof of concept study describes the design and preliminary application of a new device for upper limb treatment in patients with stroke. Electromyographic (EMG) signals of the biceps and triceps muscle serve as the input signals for the actuator. When the intended EMG signal of the biceps or triceps muscle exceeds a pre-set level of activity, the respective flexion or extension movement of the elbow joint is assisted by the device and active participation of the user is ensured. Preliminary application was performed in two subjects with chronic upper limb hemiparesis to consider feasibility of the system and validity of the device to motor functioning of the upper limb.
Results
None of the subjects experienced adverse events during or after 30 minutes training with the device. The active range of motion of the elbow joint increased in both subject after therapy. One of the two subjects demonstrated decreased spasticity of the elbow flexors measured with the Modified Ashworth Scale and one subject showed a 2 point improvement on the Fugl-Meyer upper limb assessment. The device was perceived as highly useful for improving the motor functioning of the affected upper limb by both subjects.
Conclusion
The device developed in this study has proven to be save and feasible for the training of elbow movements of the hemiparetic upper limb in patients with chronic stroke and is perceived as highly useful by the users. First results are promising but extensive research including more subjects and more frequent therapy with the device is needed to confirm clinical validity.