Technologies applied to PMR

Oral communications

CO31-001-e
Measuring ankle proprioception DURING walking using a robotized ankle-foot orthosis: Towards a quantitative method to assess clinical populations

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Introduction Evaluation of lower limb proprioception is usually done under static conditions. Sensory inputs are partially gated during movements, however. This gating might explain the lack of correlation between static proprioceptive testing and motor performance in clinical populations. The goal of the present study was therefore to determine if proprioception could reliably be estimated during actual walking.

Methods Twenty healthy subjects walked on a treadmill while wearing a robotized ankle-foot orthosis (see Noel et al., 2008; 2 visits within 2–7 days). Short-duration force perturbations (150 ms; n = 96) of graded amplitude (1–7 Nm; producing ankle deviations of 1–12°) were applied during the swing phase of gait, once every 5–10 strides. Participants pressed a hand-held button each time they felt a perturbation. To determine proprioceptive threshold, % detection was then plotted as a function of ankle deviations. A sigmoidal curve was fitted to individual subject data. Proprioceptive threshold was defined as the ankle deviation at which subjects detected 50% of the perturbations. Intraclass correlation coefficient (ICC) were then calculated to determine the test-retest reliability.

Results Median proprioceptive threshold was 5.25° (range 1.04°–9.14°; n = 20). The ICC was 0.792, indicating a good reliability.

Discussion This pilot study suggests that a threshold for movement error detection can be reliably obtained during walking in healthy subjects. This proprioceptive threshold is higher than what is reported during static tasks, likely reflecting the sensory gating occurring during movement, and emphasizing the need to perform this assessment during walking. Further studies are now underway to determine if this method can be used as a tool for proprioception assessment in clinical populations.

Keywords Robotized orthosis; Proprioception; Gait

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Use of exergames for upper extremity rehabilitation in stroke patients

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Introduction Virtual reality (VR) can promote functional rehabilitation of arm movements through environments allowing the practice of a variety of tasks while providing feedback [1]. We evaluated an affordable VR system for arm rehabilitation, developed by Jintronix Inc and based on the Microsoft Kinect, that provides three unilateral and two bilateral activities, each with ten difficulty levels.

Objectives Our objectives were to (1) determine which activities and levels of difficulty are appropriate for rehabilitation of arm movements in stroke patients with different degrees of motor impairment; and (2) determine the ease of use and subjective experience of patients using the VR arm rehabilitation system.

Methods Clinicians each supervised two to four stroke patients who participated in three 20-minute sessions with the Jintronix system. We determined the highest level of difficulty attained by patients in each activity with a performance score of at least 50%. Arm impairment was assessed using the upper extremity section of the Chedoke-McMaster Scale (CM) [2]. Patients and clinicians completed a questionnaire on the usability of the Jintronix system, based on the technology acceptance model (FD Davis [3]).

Results Fifteen clinicians supervised a total of 40 stroke patients. Over 80% of the clinicians and patients provided positive feedback in terms of ease of use and VR experience. For each activity of the Jintronix system, results indicated a positive correlation between the CM score and the maximal difficulty level reached by stroke patients.

Discussion Our data demonstrate the feasibility of using an affordable VR arm rehabilitation system in a clinical setting and provide clinical guidelines for the selection of impairment-specific difficulty levels.

Keywords Rehabilitation; Upper extremity; Stroke; Video games; Exercises; Kinect

Disclosure of interest The authors have not supplied their declaration of conflict of interest.

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