Knee posture and low back pain-related differences on postural control measurements in athletes. A case control study

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Introduction Compare postural control in athletes, with and without chronic low back pain (CLBP), during two one-legged stance tasks and identify center of pressure cut-off differences.
Material and methods Fifty-six male athletes, 28 with and 28 without CLBP (mean age = 26 years) performed on a force platform:
— one-legged stance with knee extension;
— one-legged stance with the knee at a 30° flexion, both tasks with eyes open.
Participants completed three 30-s trials (with 30-s of rest between each trial), and the mean across trials was used for subsequent analysis.
Results Athletes with CLBP had poorer postural control ($P < 0.01$) in both tasks. The 30° knee flexion showed poor postural control in all center of pressure (COP) parameters (mean effect size d = 0.80). The cut-offs identified in the knee extension position were: > 7.1 cm^2 for COP area, > 2.6 cm/s for COP sway velocity in the anterior-posterior direction and > 3.2 cm/s for medio-lateral direction. In the knee flexion position, these variables were related to: > 10.9 cm^2 for COP area, > 2.9 cm/s for COP sway velocity in the anterior-posterior direction and > 4.1 cm/s for the medio-lateral direction. Both measures showed enough sensitivity and specificity (i.e., area under curve = 0.88 in extension and 0.80 in flexion).
Conclusions Athletes with CLBP had poorer postural control than healthy athletes. Athletes with CLBP obtained specific cut-off scores on COP values for early detection of the effects of low back pain on balance.
Keywords Posture; Spine; Chronic low back pain; Athletes; Postural balance

Disclosure of interest The authors declare that they have no competing interest.

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Wearable exoskeleton control modes selected during overground walking affect muscle synergies in adults with a chronic incomplete spinal cord injury

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Introduction Changes in the number of muscles synergies (MSs) and in the weighting of muscles composing each MS are typically altered following an incomplete spinal cord injury (iSCI). To overcome this problem, locomotor training with a wearable robotic exoskeleton (WRE) represents a promising rehabilitation option though the effects of the various WRE control modes on MSs remain unknown.
Objective This case series aims to characterize how WRE control modes affect the number of MSs and the weighting of muscles composing each MSs in individuals with iSCI.
Methods Three participants with a chronic iSCI walked at a self-selected comfortable speed without and with a WRE set in different trajectory controlled (maximal assistance [MAX]; assistance-as-needed [ADAPT]) and non-trajectory controlled modes (high assistance [HASSIST], high resistance [HRESIST], and NEUTRAL). Recorded surface EMG of eight L/E muscles was used to extract the MSs using a non-negative matrix factorization algorithm. Cosine similarity and weighting relative differences characterized similarities between MSs of individuals with iSCI and against references obtained in a healthy control.
Results The mode providing movement assistance within a self-selected L/E trajectory (HASSIST) best replicates MSs observed in healthy control during overground walking. The MSs extracted with the passive (MAX) and assistance-as-needed (ADAPT) modes differed to the greatest extent from MSs characteristics extracted from a healthy reference.
Conclusions Most of the control modes selected during overground walking with a WRE did not closely replicate the motor control required for the production of coordinated L/E movements during stereotypical overground walking. These first results may allow rehabilitation professionals to refine WRE locomotor training protocols.
Keywords Coordination; Electromyography; Spinal cord injury; Rehabilitation; Technology

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Développement d'un protocole pour l'établissement d'un seuil vestibulaire chez les sujets sains

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Introduction La stimulation vestibulaire galvanique (GVS) est utilisée pour évaluer l'intégrité du système vestibulaire et améliorer notre compréhension des mécanismes de l'équilibre, mais les réponses évoquées montrent une grande variabilité interindividuelle, ce qui rend la compréhension du rôle du système vestibulaire difficile. L'objectif est de développer un protocole identifiant un seuil objectif (T) pour la GVS afin de limiter cette variabilité.
Matériels et méthodes Dix-huit sujets sains droitiers étaient debout sur une plateforme de force, les yeux fermés, la tête vers l'avant. L'accélération de la tête était enregistrée lorsque la GVS (200 ms) était appliquée à des intensités de 1—4,5 mA :