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Assessment of evertor weakness in patients with chronic ankle instability: Functional versus isokinetic testing

Romain Terrier [a,b,*], Francis Degache [c], François Fourchet [d], Boris Gojanovic [d], Nicolas Forestier [a]

[a] University Savoie – Mont BlancEA 7424 - Inter-university Laboratory of Human Movement Science, France
[b] CEVRES Santé, Savoie Technolac, BP 322, 73377 Le Bourget du lac cedex, France
[c] University of Health Sciences, University of Applied Sciences and Arts Western Switzerland, Lausanne, Switzerland
[d] Motion Analysis Laboratory, Physiotherapy Department, Hôpital La Tour, Avenue J-D Maillard 3, 1217 Meyrin, Geneve, Switzerland

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ABSTRACT

Background: Ankle sprain is the most common sport-related injury and eccentric weakness of ankle evertors is regarded as a significant muscular deficit related to chronic ankle instability. However, the eccentric performance of the evertors is rarely assessed by clinicians because procedures used for research purposes (i.e. isokinetic tests) are not easily applicable in daily practice.
Methods: The present study assessed the ability of two different testing procedures to distinguish between groups of 12 healthy subjects or 12 patients suffering from chronic ankle instability. On the one hand, the strength of evertors was assessed with a *gold standard* isokinetic procedure. On the other hand, we assessed the ability of the subjects to control ankle inversion during weight bearing (functional standing test).
Findings: Data showed no significant difference between groups for isokinetic peak torque values normalized to body weight. Conversely, the functional test revealed a significantly impaired ability to control ankle inversion during weight bearing in subjects with chronic ankle instability.
Interpretation: This suggests that this easy-to-apply functional test is better suited compared to isokinetic testing procedures to assess weakness of evertors in patients suffering from chronic ankle instability. Moreover, this test may also be used to objectively monitor improvements during rehabilitation or progression in prevention protocols.

1. Introduction

Lateral ankle sprain is the most common musculoskeletal injury reported in physically active populations; *in addition*, *the majority of patients with a history of lateral ankle sprain will sustain at least one additional sprain resulting in functional limitations and leading often to the defined condition of chronic ankle instability* (Gribble et al., 2016). Indeed, it has been shown (Freeman et al., 1965; Gerber et al., 1998; Gribble et al., 2016; Waterman et al., 2010; Willems et al., 2002) that 40 to 70% of patients who suffered an initial ankle sprain were at risk for developing Chronic Ankle Instability (CAI). CAI has been described as a consequence of either or both mechanical and functional insufficiencies (Gribble et al., 2013). Mechanical instability is conditioned by ligament laxity, impaired arthrokinematics or impingements. These deficits are usually managed by specific articular mobilizations (Hoch et al., 2012) and/or surgical approaches (Tourné et al., 2010). Functional instability is understood as sensorimotor joint control alterations (Hertel, 2002) mainly caused by proprioceptive (Munn et al., 2010) and/or ankle evertor muscles strength deficits (Pietrosimone and Gribble, 2012). Rehabilitation aims to restore these key parameters using supervised protocols, including specific proprioceptive and strengthening exercises.

Rehabilitation specialists also need to perform simple and reliable functional tests in order to (i) identify individuals suffering from functional deficits potentially leading to CAI and (ii) objectively assess improvements during the rehabilitation process. On the one hand, dynamic postural control deficits associated with CAI can be assessed using the well-known star excursion balance test (see Gribble et al., 2012 for a review). On the other hand, the eccentric performance of the ankle evertors is of primary interest as it takes part in the active control of the sudden anke inversion (Collado et al., 2010; Graziani et al., 2001; Munn et al., 2003). While isokinetic eccentric muscular weakness has been considered as a factor responsible for CAI by some authors (Abdel-Aziem and Draz, 2014; David et al., 2013; Hartsell and Spaulding, 1999; Willems et al., 2002; Yildiz et al., 2003; Tropp, 1986), it is worth noting that there is no clear consensus about the relationships between evertor isokinetic weakness and CAI (Bernier et al., 1997; Kaminski et al., 1999; Kwon et al., 2013; Lentell et al., 1990). In

* Corresponding author at: Laboratoire Interuniversitaire de Biologie de la Motricité (E.A. 7424), Département des Sciences et Techniques des Activités Physiques et Sportives (STAPS), Université Savoie Mont-Blanc, 73376 Le Bourget du lac, France.
E-mail address: romain.terrier@cevres.com (R. Terrier).

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