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Impaired control of weight bearing ankle inversion in subjects with chronic ankle instability

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ABSTRACT

Background: Previous studies have proposed that evertor muscle weakness represents an important factor affecting chronic ankle instability. For research purposes, ankle evertor strength is assessed by means of isokinetic evaluations. However, this methodology is constraining for daily clinical use. The present study proposes to assess ankle evertor muscle weakness using a new procedure, one that is easily accessible for rehabilitation specialists. To do so, we compared weight bearing ankle inversion control between patients suffering from chronic ankle instability and healthy subjects.
Methods: 12 healthy subjects and 11 patients suffering from chronic ankle instability conducted repetitions of one leg weight bearing ankle inversion on a specific ankle destabilization device equipped with a gyroscope. Ankle inversion control was performed by means of an eccentric recruitment of evertor muscles. Instructions were to perform, as slow as possible, the ankle inversion while resisting against full body weight applied on the tested ankle.
Results: Data clearly showed higher angular inversion velocity peaks in patients suffering from chronic ankle instability. This illustrates an impaired control of weight bearing ankle inversion and, by extension, an eccentric weakness of evertor muscles.
Interpretation: The present study supports the hypothesis of a link between the decrease of ankle joint stability and evertor muscle weakness. Moreover, it appears that the new parameter is of use in a clinical setting.

1. Introduction

Data from 16 years of injury surveillance for 15 sports revealed that ankle sprain was the most common injury and that it accounts for 15% of all reported injuries (Hootman et al., 2007). Other researchers have reported that lateral ankle sprain incidence can reach 25% of all sport related traumatisms (O'loughlin et al., 2009). Beyond a simple acute injury, several studies (Freeman et al., 1965; Gerber et al., 1998; Yeung et al., 1994) revealed that 40–70% of patients who suffered from an initial ankle sprain are at risk for developing chronic ankle instability (CAI). CAI is mainly characterized by recurrent injuries, ankle joint instability, and frequent ankle inversion destabilization without capsulo-ligamentar injury also called "giving way" (Delahaunt et al., 2010; Zhang, 2012). As highlighted by Hertel (2002), CAI may be the consequence of mechanical instability, functional instability or a combination of both.

It has been theorized that fibularis (ankle evertors) weakness could decrease the joint dynamic stability and therefore largely contribute to functional joint instability (Fox et al., 2008; Lentell et al., 1995). As highlighted by Kaminski et al. (1999) or Fox et al. (2008), conflicting results have been reported. Some studies have shown deficits of ankle evertor strength in subjects suffering from chronic ankle instability (CAI) when compared to healthy subjects (e.g. Hartsell and Spaulding, 1999; Kannus and Renstrom, 1991; Staples, 1975; Tropp, 1986; Willems et al., 2002) while other studies found no significant differences (e.g. Bernier et al., 1997; Kaminski et al., 1999; Lentell et al., 1990; McKnight and Armstrong, 1997; Munn et al., 2003). Studies dealing with ankle evertor strength evaluation are classically based on isokinetic tests. Following a standardized procedure proposed 20 years ago (Leslie et al., 1990; Simoneau, 1990), it has been demonstrated that ankle eversion peak torque produced in isokinetic movement gives a reliable measurement of evertor strength for healthy (Aydog et al., 2004) and CAI subjects (De Nohonha and Borges, 2004; Sekir et al., 2008). However, such assessment procedures are not widely used by rehabilitation specialists because the equipment is expensive and the evaluation procedure preparation is time consuming. Actually, it is difficult for rehabilitation specialists to find reliable muscle measurement procedures (De Nohonha and Borges, 2004; Eggart et al., 1993; Plante and Wikstrom, 2013) and evertor weakness is generally not objectively assessed in clinical daily practice. Several research

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