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The effects of joint hypermobility syndrome on the kinematics and kinetics of the vertical jump test

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ABSTRACT

Purpose: Biomechanical impairments are not apparent during walking in people with Joint Hypermobility Syndrome (JHS). This research explored biomechanical alterations during a higher intensity task, vertical jumping.
Materials and methods: This cross-sectional study compared a JHS group (n = 29) to a healthy control group (n = 30). Joint kinematics and kinetics were recorded using a Qualisys motion capture system synchronized with a Kistler platform. Independent sample t-tests and standardised mean differences (SMD) were used for statistical analysis.
Results: No significant statistical or clinical differences were found between groups in joint kinematics and jump height ($p \geq 0.01$). Sagittal hip and knee peak power generation were statistically lower in the JHS group during the compression phase ($p \leq 0.01$), but not clinically relevant (SMD < 0.5). Clinically relevant reductions were found in the JHS group knee and ankle peak moments during the compression phase, and hip and knee peak power generation during the push phase (SMD ≥ 0.5), although these were not statistically significant ($p \geq 0.01$).
Conclusion: The JHS group achieved a similar jump height but with some biomechanical alterations. Further understanding of the joint biomechanical behavior could help to optimize management strategies for JHS, potentially focusing on neuromuscular control and strength/power training.

1. Introduction

Joint hypermobility syndrome (JHS) is a heritable connective tissue disorder associated with symptomatic multiple joint laxity without signs of systemic inflammation (Hakim and Grahame, 2003; Hakim et al., 2004; Simmonds and Keer, 2007). JHS is caused by a deficiency in the genes encoding collagen which compromises the rigidity of the connective tissues of the body (2003;; Narcisi et al., 1994; Malfait et al., 2006; Syx et al., 2015). It is considered a multi-systemic disorder impacting the musculoskeletal, cardiovascular, digestive and autonomic nervous systems (Hakim and Grahame, 2003). JHS was found to have 30% prevalence from the referrals to a musculoskeletal triage service in the United Kingdom, and it is more common in women than men (Simmonds and Keer, 2007; Connelly et al., 2014). It is associated with various symptomatic manifestations. Beside the multiple joint laxity and chronic pain, JHS is associated with muscle weakness, reduced musculotendinous stiffness, impaired proprioception and postural balance, recurrent injuries and fatigue; which in turn reduce physical and psychological wellbeing (Hakim and Grahame, 2003; Hakim et al., 2004; Simmonds and Keer, 2007; Rombaut et al., 2010; Toker et al., 2010; Fatoye et al., 2012; Alsiri et al., 2019). It has been accepted that JHS and Ehlers-Danlos Syndrome-Hypermobility type (EDS-HT) are indistinguishable with similar phenotypic identification (Hakim and Grahame, 2003; Hakim et al., 2004; Simmonds and Keer, 2007; Tinkle et al., 2009). The term JHS will be used in the present study to encompass both diagnoses. It should be noted that the diagnostic criteria were updated recently for hypermobility-related disorders (Castori et al., 2017; Malfait et al., 2017). However, this study was performed before the development of the new criteria.

JHS is a disabling condition with a multidimensional impact, therefore it is a complex condition to manage. Previous reviews and studies have highlighted the serious impact of JHS on people's lives, which complicates the ability to provide adequate management (Grahame, 2001). A meta-analysis of the symptoms and management of JHS concluded that various factors limit the ability to provide adequate management, including a lack of clinical outcomes, scarcity in understanding the pathways of disability, and insufficient diagnostic criteria (Scheper et al. 2016).

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