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RESEARCH ARTICLE

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Gait biomechanics in joint hypermobility syndrome: a spatiotemporal, kinematic and kinetic analysis

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Abstract

Introduction: Joint hypermobility syndrome (JHS) symptoms of widespread joint hypermobility and pain, muscle weakness and reduced muscle-tendon stiffness suggest that there may be an impact on gait parameters. Identification of gait abnormalities may inform assessment and management. The objective in the present study was to use a cross-sectional designed study to explore the impact of JHS on gait parameters.

Methods: A JHS group of 29 participants (mean age 37.57 (S.D. 13.77) years) was compared to a healthy control group of 30 participants (mean 39.27 (S.D. 12.59) years). Spatiotemporal parameters, joint kinematics and joint kinetics were captured using the Qualisys motion capture system synchronized with a Kistler force platform.

Results: Statistically significant reductions in walking speed, stride length and step length were found in the JHS group, while stance and double support durations were significantly increased ($p < 0.01$). During the swing phase, the JHS group showed significantly less knee flexion ($p < 0.01$). Reductions in hip extensor moment, and knee power generation and absorption were identified in the JHS group ($p < 0.01$). No other gait parameters were significantly altered.

Conclusion: The JHS group walked more slowly with a kinematic 'stiffening' pattern. Hypermobility was not evident during gait. The observed stiffening pattern could be a strategy to avoid pain and improve balance. Impairments in moment and power generation could be related to several symptomatic and etiological factors in JHS. Clinicians should carefully consider gait in the assessment and management of people with JHS targeting the impairments identified by the current study.

KEYWORDS
gait, joint hypermobility syndrome, kinematic, kinetic, three-dimensional

1 | INTRODUCTION

Joint hypermobility syndrome (JHS) is an inherited connective tissue disorder in which multiple synovial joints demonstrate symptomatic and excessive motion in the absence of systemic inflammation (Hakim, Cherkas, Grahame, Spector, & MacGregor, 2004; Hakim & Grahame, 2003). JHS is multi-systemic, adversely affecting the musculoskeletal, cardiovascular, digestive and autonomic nervous systems due to abnormalities in the connective tissues of these systems, which changes their physiology (Hakim & Grahame, 2003). JHS is a severe and disabling condition found in 30% of those referred to a musculoskeletal triage service in the United Kingdom (Connelly, Hakim, Davenport, & Simmonds, 2014). The hypermobility type of Ehlers-Danlos

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