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JOINT HYPERMOBILITY AS A FUNCTIONAL CONNECTIVE TISSUE DISORDER: CLINICAL IMPLICATIONS AND THE NEED FOR STANDARDIZATION OF SUPPORT PROTOCOLS

Joint hypermobility is most defined as an increased range of motion within the joints; however, this definition fails to capture its complexity. It is currently understood as a multidimensional condition resulting from the interaction among connective tissue properties, neuromuscular control, and biochemical processes that influence the function of the musculoskeletal system. Despite increasing clinical awareness, hypermobility remains underrecognized, particularly in cases lacking a formal diagnosis (hEDS, HSD; Castori et al., 2017; Malfait et al., 2017).

The functioning of the musculoskeletal system is dependent on the properties of connective tissue, including collagen and the organisation of the extracellular matrix (Malfait, 2020; September et al., 2009). In hypermobility, qualitative alterations in collagen structure, its organisation, and cross-linking processes are observed, leading to altered biomechanical properties of tissues. Although hypermobile Ehlers–Danlos syndrome (hEDS) and hypermobility spectrum disorders (HSD) do not have a clearly defined genetic basis, polymorphisms in genes associated with the extracellular matrix, such as *COL5A1* and *TNXB*, have been implicated in influencing tissue mechanical properties (Malfait et al., 2017; September et al., 2009).

Metabolic and nutritional factors influencing collagen synthesis are also of significant importance. This process depends on the availability of amino acids such as glycine and proline, as well as vitamin C, which plays a crucial role as a cofactor in hydroxylation reactions necessary for collagen stabilisation. Although clinical evidence directly linking nutritional interventions to improved connective tissue function in hypermobility remains limited, disruptions in these processes may further

exacerbate abnormal biomechanical properties of connective tissue, leading to reduced passive joint stability and increased load on the muscular system.

The clinical relevance of hypermobility primarily stems from its functional consequences. The most common include postural instability, impaired proprioception (Rombaut et al., 2010), reduced muscle strength and endurance, and increased fatigability. The lack of passive stabilisation necessitates muscular compensation, increasing the energetic cost of movement and predisposing to overload injuries. Disturbances in neuromuscular control (Clayton & Jones, 2022) are also significant, as is the frequent co-occurrence of dysautonomia, including postural orthostatic tachycardia syndrome (POTS) (Roma et al., 2018). Pain is multifactorial and often involves central sensitisation (Baeza-Velasco et al., 2018).

Despite the complexity of the condition, clinical practice remains inconsistent. The lack of standardised diagnostic and therapeutic guidelines leads to fragmented care (Demmler et al., 2019). Interventions are predominantly focused on physiotherapy (Palmer et al., 2014), often overlooking metabolic and nutritional aspects that may influence connective tissue function.

Effective patient management requires the development of interdisciplinary protocols encompassing three key components: comprehensive functional assessment (including stability, proprioception, and motor control), targeted therapeutic interventions focused on low-load stabilisation and strength training, and metabolic and nutritional support combined with patient education. Diagnostic criteria based solely on range of motion are insufficient and should be expanded to incorporate functional parameters reflecting real-world impairment (Castori et al., 2017).

Failure to adopt a multidimensional approach may contribute to delayed diagnosis, misclassification, and suboptimal management of patients with joint hypermobility. Therefore, the standardisation of diagnostic and therapeutic strategies – integrating biomechanical, biochemical, and genetic perspectives – is not only a direction for future research but a clinical necessity. Such an approach has the potential to improve diagnostic accuracy, optimise treatment outcomes, and reduce the burden of long-term complications associated with inadequate or fragmented care.

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