

# Joint Hypermobility Syndrome Pain

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Joint hypermobility syndrome (JHS) was initially defined as the occurrence of musculoskeletal symptoms in the presence of joint laxity and hypermobility in otherwise healthy individuals. It is now perceived as a commonly overlooked, underdiagnosed, multifaceted, and multisystemic heritable disorder of connective tissue (HDCT), which shares many of the phenotypic features of other HDCTs such as Marfan syndrome and Ehlers-Danlos syndrome. Whereas the additional flexibility can confer benefits in terms of mobility and agility, adverse effects of tissue laxity and fragility can give rise to clinical consequences that resonate far beyond the confines of the musculoskeletal system. There is hardly a clinical specialty to be found that is not touched in one way or another by JHS. Over the past decade, it has become evident that of all the complications that may arise in JHS, chronic pain is arguably the most menacing and difficult to treat.

## Introduction

Joint hypermobility syndrome (JHS) was originally perceived as a purely local articular problem affecting otherwise healthy people, whose range of joint motion happen to lie at the upper end of a normal range, and who suffer mechanical joint problems (pain, instability, dislocation, and premature osteoarthritis). This perception has undergone a sea of change over the past four decades [1]. It is now viewed as a heritable disorder of connective tissue (HDCT) in its own right, caused by an undetermined genetic abnormality affecting one of the connective tissue matrix proteins [2,3•]. The current prevailing wisdom is that JHS is indistinguishable from—if not truly identical to—the hypermobility type of Ehlers-Danlos syndrome (EDS), formerly classified as EDS type III [4].

## Definitions of Joint Hypermobility and Joint Hypermobility Syndrome

It is important to clarify the difference between the terms *joint hypermobility* (JH) and *joint hypermobility syndrome* (JHS). JH is defined as an excessive range of motion of a joint taking into consideration the patient's gender, age, and ethnic background, with the range being greater in females, younger people in general (including children, adolescents, and young adults), and those of Asian or African origin. A number of scoring systems have been devised to identify its presence clinically, of which the Beighton 9-point scoring system is probably the mostly widely used [5] (Table 1) (Fig. 1). A score of  $\geq 4$  of 9 points is usually taken to be indicative of widespread hypermobility. The scale was devised for epidemiological use, and it is not advised to rely solely on the Beighton score as a means of diagnosing JHS.

A reliable alternative measure for identifying hypermobility is a simple statistically validated 5-part questionnaire, which has certain advantages in that it does not require a physical examination, nor does the subject have to be physically present [6] (Table 1).

By definition, JH only becomes JHS when symptoms attributable to JH occur, which is by no means inevitable. The likely scenario is that most hypermobile subjects experience little or no such symptoms. In others, symptoms may develop during childhood, adolescence, or adult life, depending on lifestyle and exposure to injury.

## Joint Hypermobility Syndrome

### Brighton criteria

In 1998, the Brighton criteria for JHS was introduced by the Special Interest Group on Heritable Disorders of Connective Tissue of the British Society for Rheumatology [7] (Table 2). It consists of a set of major and minor classification criteria similar to the earlier published criteria for other HDCTs such as the Ghent criteria for Marfan syndrome [8] and the Villefranche criteria for EDS [9]. The diagnosis of JHS rests not just on the finding of joint hypermobility, but includes an examination of other aspects of tissue laxity, such as increased skin stretchiness, paper thin scars, striae atrophicae (stretch marks that occur during the adolescent growth spurt), features of the marfanoid habitus, and evidence of weakness of visceral supporting structures such as the abdominal wall (hernia), pelvic floor (genital prolapse), and varicose veins. A positive Gorlin's sign (ability to touch the nose with the

**Table 1. Scoring systems used to identify joint hypermobility**

<b>Beighton 9-point scoring system [5]*</b>		
<b>Maneuver</b>	<b>Right</b>	<b>Left</b>
Ability to passively dorsiflex the 5th metacarpophalangeal joint to 90°	1 point	1 point
Ability to appose the thumb to the volar aspect of the ipsilateral forearm	1 point	1 point
Ability to hyperextend the elbow joint to beyond 10°	1 point	1 point
Ability to hyperextend the knee joint to beyond 10°	1 point	1 point
Ability to place hands flat on the floor by bending forward with knees fully extended	1 point	–
Total	9 of 9 points	
<b>5-part questionnaire [6]†</b>		
1. Can you now or could you ever place your hands on the floor by bending forward with your knees straight?		
2. Can you now or could you ever bend your thumb to touch your forearm?		
3. As a child did you amuse your friends by contorting your body into strange shapes or could you do the splits?		
4. As a child or teenager did your shoulder or knee cap dislocate on more than one occasion?		
5. Do you consider yourself double-jointed?		
*See Figure 1 for photos of the maneuvers.		
†Answering “yes” to any two questions indicates the presence of hypermobility with a high degree of accuracy. The sensitivity and specificity were 84% and 87%, respectively.		
(Data from Beighton et al. [5] and Hakim and Grahame [6].)		

tip of the tongue) and the absence of the lingual frenulum are further signs of tissue laxity and are additional diagnostic pointers [10]. Because of the veritable explosion of new knowledge about JHS that has accumulated in the past two decades, in particular, multisystemic involvement, the perception of the condition constantly has to be revised [3•].

### Musculoskeletal features and their management

JHS is characterized by an inherent increase in laxity and fragility of the connective tissues. Ligamentous laxity facilitates hypermobility. As an unexpected benefit, the added ranges of motion turn out to favor selection into the performing arts [11]. The biological price for this enhanced flexibility is tissue fragility, which underlies the musculoskeletal elements of JHS. Tissues such as tendon, ligament, bone, cartilage, and skin, which rely on the considerable tensile strength of their collagen component for their physical integrity, are more likely to fail mechanically in hypermobile people compared with others. This inevitably takes its toll in many patients who are attracted to the performing arts (or other demanding activities) in which the physical demands may exceed the body's ability to withstand them [12].

In all patients with JHS, a general predisposition to soft tissue injury exists, coupled with an impairment of healing that is not only slow but may be incomplete. Scar tissue is, of course, also collagen, which explains why scars in patients with JHS are usually of poor quality (ie, thin, shiny, and often sunken below the surrounding skin).

In clinical terms, the result is a tendency for the patient to have ankle and other sprains, muscle tears, tendon–bone attachment traction lesions (enthesopathies), menis-

cus tears, stress fractures, other overuse lesions (eg, work- and performance-related upper limb disorders), and noninflammatory spinal and joint pain with varying degrees of degenerative joint disease.

Astonishingly, up to 45% of all patients referred to general rheumatology clinics satisfy the Brighton criteria and may therefore be said to have JHS, indicating that this is a very common at-risk phenotype in the community at large [13,14].

JHS often makes its presence known in childhood, during which it can manifest as motor delay, ankle instability, flat feet, clumsiness, fidgetiness, and developmental coordination disorder (dyspraxia). As in adults, it may also progress to a chronic pain syndrome [15].

### Neurophysiologic, neurologic, and neuropsychiatric features

There is more to JHS than vulnerability to soft tissue injury and its consequences. Over the past two decades it has become apparent that patients with JHS also suffer from various ailments linked to central and peripheral nervous system abnormalities. For example, there is a significant (though reversible [16]) impairment of joint proprioceptive acuity [17], an amplification of pain in both children and adults [18], a resistance to local anesthetics [19], and substantial evidence of autonomic dysfunction [20,21]. Most recently discovered was a pan-intestinal dysmotility causing symptoms usually attributed to irritable bowel syndrome [22•]. An association between hypermobility and fibromyalgia (FM) has been established in both adults and children, but not as yet with JHS classified according to the Brighton criteria [23,24]. Likewise, a strong association has been established between FM (but not yet with



**Figure 1.** The 9-point Beighton scoring system for joint hypermobility showing the patient's ability to (A) passively dorsiflex the 5th metacarpophalangeal joint to 90°; (B) appose the thumb to the volar aspect of the ipsilateral forearm; (C) hyperextend the elbow joint to beyond 10°; (D) hyperextend the knee joint to beyond 10°; and (E) place hands flat on the floor by bending forward with knees fully extended.

**Table 2. Revised 1998 Brighton diagnostic criteria for joint hypermobility syndrome\*****Major criteria**

1. A Beighton score of  $\geq 4$  of 9 points (either currently or historically)
2. Arthralgia for  $> 3$  months in four or more joints

**Minor criteria**

1. A Beighton score of 1, 2, or 3 of 9 points (0, 1, 2, or 3 points if  $\geq 50$  years old)
2. Arthralgia ( $\geq 3$  months) in one to three joints or back pain ( $\geq 3$  months), spondylosis, or spondylolysis/spondylolisthesis
3. Dislocation/subluxation in more than one joint, or in one joint on more than one occasion
4. Soft tissue rheumatism:  $\geq$  three lesions (eg, epicondylitis, tenosynovitis, bursitis)
5. Marfanoid habitus (tall, slim, span/height ratio of  $> 1.03$ ; upper/lower segment ratio of  $< 0.89$ ; arachnodactyly [positive Steinberg/wrist signs])
6. Abnormal skin: striae, hyperextensibility, thin skin, papyraceous scarring
7. Eye signs: drooping eyelids, myopia, or antimongoloid slant
8. Varicose veins, hernia, or uterine/rectal prolapse

\*Joint hypermobility syndrome is diagnosed if the patient presents with two major criteria; one major and two minor criteria; or four minor criteria. Two minor criteria will suffice if there is an unequivocally affected first-degree relative. Major 1 and Minor 1 criteria are mutually exclusive, as are Major 2 and Minor 2. Joint hypermobility syndrome is excluded by the presence of Marfan syndrome or Ehlers-Danlos syndrome (other than the Ehlers-Danlos hypermobility type [formerly EDS type III]) as defined by the Ghent 1996 [8] and the Villefranche 1998 [9] criteria, respectively. (Data from Grahame et al. [7].)

JHS) and certain psychiatric states, including panic disorders and phobic states [25]. A chromosomal link between hypermobility and these psychiatric disorders involving a genomic duplication in chromosome 15 has been reported, but has yet to be confirmed [26].

It has long been suspected that peripheral nerves would likely be at risk of injury in the face of JH through increased movement of and traction on the nerve. Reports of carpal and tarsal tunnel syndrome occurring in patients with JH appeared in earlier literature. A recent study of 55 patients with JHS using the Brighton criteria showed a highly significant correlation between the presence of electrophysiologically proven carpal tunnel syndrome and the occurrence of JHS [27].

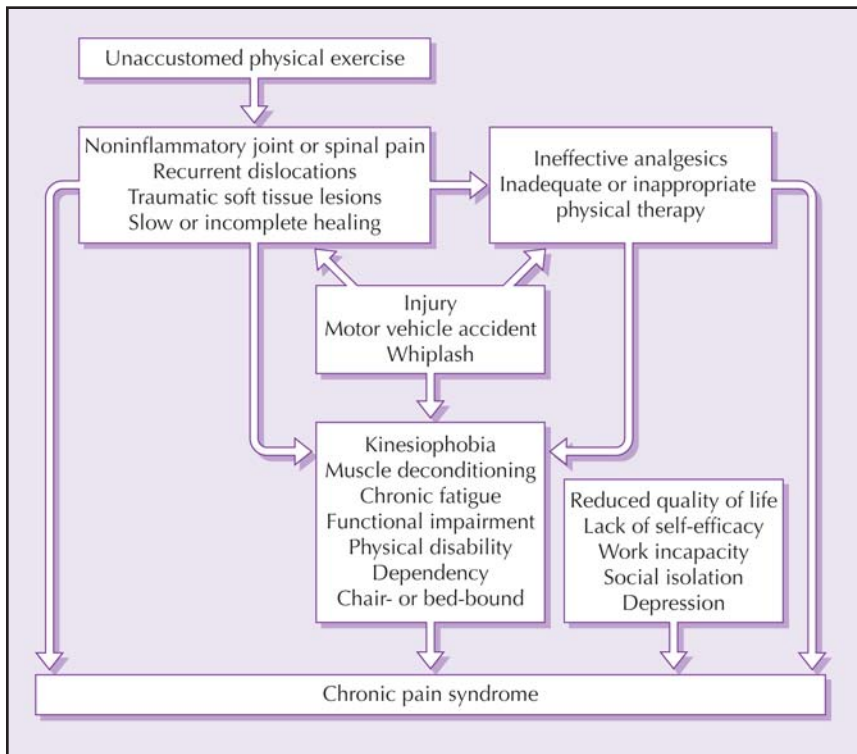
Headaches of cervicogenic origin occur in hypermobile individuals. New light has been shed on the role of the cervical spine in the pathogenesis of headache in hypermobile subjects in a recent study in which 11 of 12 patients with daily persistent headache were found to have excessive intersegmental vertebral motion in the cervical spine. All 12 patients showed evidence of widespread hypermobility using the Beighton scale. It was suggested that hypermobility of the cervical spine may be an important factor in the pathogenesis of new daily persistent headache [28].

Recurrent orthostatic headache due to spontaneous intracranial hypotension is becoming increasingly recognized, with the presumed mechanism being leakage of cerebrospinal fluid from the subarachnoid space. Of 18 patients thus presenting in one series, no less than seven (38%) showed evidence of a connective tissue disorder, including types of EDS. The authors postulated that the leakage from the dural membranes may have resulted from their inherent fragility [29].

## Chronic Pain and Joint Hypermobility Syndrome Relationship

Chronic pain is a frequent feature of JHS. Of 700 JHS patients attending the author's specialist hypermobility clinic at University College Hospital (London, United Kingdom), 26% admitted that their pain was life-dominating at their first attendance (Grahame, unpublished data). Yet, it was only in the past decade that the existence of a link between JHS and chronic pain had been discovered [16]. The onset of chronic pain is usually insidious, superimposing itself on the pattern of often widespread musculoskeletal pain that went before. Chronic pain is very different from acute pain. Unlike its acute counterpart, chronic pain has the following unique characteristics: it cannot be reliably traced to a specific injury; its distribution is diffuse without conforming to anatomical patterns; it may cover the whole body, half the body (top or bottom or left or right), or just a quadrant; it may be accompanied by dysesthesia, hyperesthesia, or allodynia (the tender points in FM); and it is generally impervious to even the most potent analgesics, including opiates. In JHS, chronic pain is often aggravated by body movement of any kind so that, whether consciously or not, the affected individual resorts to a strategy of movement avoidance as a means of pain avoidance, a process termed *kinesiophobia* [30]. This has the effect of aggravating muscle deconditioning, which is the very opposite of what is required by a person whose joints are naturally unstable through joint laxity. Not surprisingly, it often plunges them into a vicious downward spiral of declining function and loss of independence, self-esteem, and self-efficacy.





**Figure 2.** The pathogenesis of chronic pain syndrome in joint hypermobility syndrome.

This downturn in the patient's fortune rarely occurs out of the blue, and it can usually be traced to either a change in lifestyle (eg, new job or leisure activity involving greater physical demands on the patient's already compromised locomotor system) or a sudden traumatic event (eg, an unaccustomed physical challenge [running in a race, undertaking overambitious home improvements] or an injury [eg, whiplash following a motor vehicle accident]). Not only does the intensity of the superimposed diffuse chronic pain increase progressively over time, but so does the level of the preexisting pains, be they joint, spinal, or soft tissue in origin, which increases in parallel. The level of distress is heightened further both by chronic fatigue (which may be just as debilitating as the pain itself) and associated depression. Sadly, for many patients in this situation, their medical attendants may be unaware of the connection between JHS and this level of pain, and they are either not believed or are told that "it is all in the mind" [3•]. The pathogenesis of chronic pain syndrome in JHS is illustrated in Figure 2.

### Management

There are two principal strands in the rehabilitation of JHS patients with chronic pain. First and foremost is the physical rehabilitation of the unique combination of musculoskeletal problems that arise in JHS from 1) joint laxity and instability; 2) muscle weakness that results from the underuse of key muscles, especially those that control spinal posture; and 3) lack of proprioceptive input. This is enshrined in a novel approach to JHS rehabilitation, which, curiously, has not yet found favor in the United States [31–33]. In brief, the program comprises a combination of

core- and joint-stabilizing and proprioception-enhancing exercises coupled with a general fitness program aimed at reversing the inevitable muscle conditioning that results from pain inhibition and kinesiophobia [28], together with the prudent use of mobilizing techniques in order to restore those secondarily stiffened spinal segments or peripheral joints to their natural hypermobile state where possible. These approaches have the potential to rectify many of the mechanical defects that JHS patients present with in the office setting. In so doing, symptoms such as joint and spinal pain and instability may be relieved; at the same time, fitness and stamina are enhanced with the restoration of a sense of well-being.

The second strand involves the use of a pain management program based on cognitive behavioral therapy methodology. This approach is applicable to patients whose pain is intractable, life-dominating, and unresponsive to analgesics or other physical interventions, which occurs in many patients with JHS and chronic pain. Its aim is to enable patients to manage (take charge of) their pain so that they will be enabled to carry on with their lives in spite of it. Unlike the physical rehabilitation described in the first strand, it does not aim to abolish the pain. In other words, the two strands are complementary to one another.

The program is normally administered to small groups of patients by a clinical psychologist (with special training in pain psychology) working together with a pain physiotherapist. Other members of the team may include an occupational therapist, a nurse, a pharmacist, and a medically qualified specialist. The aims are to improve understanding of chronic pain, reduce pain-related distress, improve communication with others (in particular

about chronic pain), return to valued and enjoyable activities, improve physical functioning and reduce disability, improve sleep, and develop ways to manage increases in pain [34•]. Anecdotally, many patients with JHS have been helped considerably by taking part in a pain management program of this nature. To date there have been no clinical trials of efficacy.

## Conclusions

JHS is a frequently encountered disorder in clinical practice. The syndrome is not commonly recognized because it is usually not looked for in the clinical examination. This article has set out to enable readers to identify patients who are hypermobile and therefore at risk of developing JHS in its many guises. JHS is a multifaceted condition that may adversely affect the functioning of connective tissue in any bodily system. It is a very common (perhaps the most common) cause of chronic pain and certainly one of the most challenging to manage.

## Disclosure

No potential conflict of interest relevant to this article was reported.

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