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Hypermobility and Sports Injury

Nathan J¹, Davies K¹, Swaine I²

Authors

Dr Joseph A Nathan (Corresponding author)
Professor Kevin Davies (Co-author)
Professor Ian Swaine (Co-author)

1. Brighton and Sussex Medical School, Rheumatology, BSMS Teaching Building, University of Sussex, Falmer, Brighton, UK
2. University of Greenwich, Faculty of Engineering and Science, Life and Sports Sciences, London, UK

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Correspondence to: -

Dr Joseph Nathan
Flat 11, 73 Broadfield Lane
London
NW1 9DJ

Email: josephnathan@doctors.org.uk
Mobile: 07986 044 726
Abstract

Objective

To determine whether there is an association between hypermobility and sports injury.

Method

A quantitative observational approach using a cross sectional survey was adopted. Individuals were identified as hypermobile or not. All participants were asked to complete two questionnaires; one asking demographic information; the other injury specific. Fisher's exact test was used for statistical analysis.

Results

114 individuals participated in the study. 62 women and 52 men. 26% of participants were hypermobile. There was no significant association between hypermobility and sports injury (p = 0.66). There was a significant increase in joint and ligament sprain amongst the non-hypermobile (NH) group covering all sports (p = 0.03). Joint dislocation was found exclusively amongst hypermobile individuals. Duration of injury in hypermobile individuals was higher than NH. Oral painkillers or anti-inflammatory drugs in the semi-professional group was greater than the general population.

Conclusion

Hypermobility is relatively common amongst individuals and there is a lot of anecdotal evidence associating it with increased rates of injuries. This project finds that NH individuals are more likely to sustain a ligament or joint sprain in sports. This is due to increased joint laxity and flexibility preventing injury.

There were important limitations in this study which will be addressed in further work. These limitations include; assessing for pauci-articular hypermobility, focusing on one sport to investigate its association with sports injury in those that were hypermobile or not and it would also be important to focus on one specific joint, assessing it’s flexibility and association with injury.
What are the new findings?

- There was a reduced likelihood of sustaining a joint or ligament sprain in individuals that were hypermobile (p = 0.03). This is thought to be due to increased joint laxity and range of movement within the joint. This can be a protective factor for injury in many sports and individuals who are hypermobile may also be attracted to certain sports as the likelihood of injury is less.
- Regular stretching may increase flexibility and this could subsequently reduce rates of injury in those that are less flexible.
- Timeframe of injury in hypermobile individuals was on average greater than non-hypermobile individuals. This may indicate that hypermobile individuals sustain more severe injuries compared to those that are not. Awareness of this may help hypermobile individuals seek injury prevention strategies.

How might it impact on clinical practice in the near future?

- This paper does not find an increased rate of sports injuries in hypermobile individuals compared to those who are not (p = 0.66). This can encourage hypermobile participants to engage in sports without a concern that they are more likely to sustain injury.
- There were important limitations in this study which will be addressed in further work.
- These limitations include; assessing for pauci-articular hypermobility, focusing on one sport to investigate its association with sports injury in those that were hypermobile or not and it would also be important to focus on one specific joint, assessing it’s flexibility and association with injury.
Introduction

Joint Hypermobility (JH) is an extremely heritable condition in which joints have a range of motion beyond normal limits (1). The prevalence of hypermobility declines with age, falling from 34% in subject’s ages 20–30 years to 18.4% in those ages 60 years or older (2). The prevalence is greater in females than males, generally a 2:1 ratio is observed (3). Joint hypermobility is a condition that is seen frequently in healthy individuals who do not have complaints. It is important to differentiate this from Joint Hypermobility Syndrome (JHS) which is a recognised Rheumatological condition which arises when a hypermobile joint is associated with arthralgia, soft tissue injury or joint instability (4). Hypermobility is diagnosed as a Beighton score of four or above.(5)

Inherent hypermobility can attract individuals to certain sports, as activities are easier to perform. However, it can also carry some disadvantages as rates of injury in certain sports are shown to be higher (6).

Anecdotal evidence suggests that being hypermobile increases the likelihood of sustaining injury in contact sports whilst in non-contact sports it may act as prevention. This may be because hypermobile joints are unstable in nature due to their increased range of movement and subsequently reduced core stability. Subsequently, when impact occurs they are not able to direct the force through the joint in a stable manner. In contact sports this causes joints to be in unstable positions due to their hypermobile nature and when exposed to physical contact leads to injury. One may also hypothesise that JH may prevent injury in sports that require increased flexibility as there is less stress put through an already flexible joint. An example that highlights this is if a runner misplaces their footing a flexible joint is able to move in the desired direction without sustaining injury. However, in a less flexible joint an injury may occur. Hypermobile individuals may also be attracted to certain sports that require increased flexibility as certain movements are easier to perform e.g. hypermobility and being a gymnast (7). It has also been suggested that training can increase flexibility.

Beighton Score

The Beighton score is an edited version of the Carter/Wilkinson scoring system, which was used as an indicator of widespread hypermobility. A Beighton score is useful as a research tool to indicate generalised hypermobility. It is straightforward to perform clinically but a high Beighton score does not mean an individual has a hypermobility syndrome. A hypermobility syndrome requires both signs and symptoms to be present before a diagnosis (8). Likewise, a low score should be considered with caution as hypermobility can present as chronic pain in joints that are not assessed by the Beighton score e.g. neck, jaw, back or shoulder pain(9). Medical professionals vary in their interpretations of the results; some accepting as low as 1 out of 9 as being hypermobile. The general consensus is that a score of 4 or more defines hypermobility(10)
Literature Review

A literature search was conducted using PubMed, CINAHL, Medline and Google Scholar. The search terms set were 'hypermobility', 'sport' and 'injury' and only peer-reviewed journals were included in the results. In addition, only papers since the year 2000 were selected and those that were published in English. Abstracts were not included in search results.

There does not appear to be a clear consensus that identifies an association between hypermobility and sports injury. Some papers suggest there is one however there is limited statistical evidence to support the finding(11-15). Other papers suggest that being hypermobile may prevent injury in certain sports(9, 12, 16, 17). Most research finds no association at all(16, 18, 19). Most papers analyse a single sport.

Pilot Study and Focus Group

A small-scale pilot study and focus group was performed before commencement of data collection. There were two aims; the first was to identify whether the questionnaires designed asked appropriate questions and were clear in instruction (this was fed back through the focus group) and the second was to determine whether the results were able to be analysed using the appropriate statistical test. The focus group provided an insight into how individuals thought and provided a deeper understanding of the area being studied. Focus groups can also be used for feedback and integration of a study design (20).

Methodology

Below are the individuals that participated in the research project:

- University of Sussex medical student sports teams including; football (male), hockey (male and female), rugby (male) and netball (female)
- A Brighton and Hove running club (male and female)
- Individuals that were found to also participate in other sports e.g. swimming, tennis, squash and cycling.

University of Sussex sports teams were invited through contact with the individual sports team captains. Teams were met after a weekday training session and the nature of the research project was explained. Participants completed a consent form and were given a patient information sheet. A second date was arranged to enable data collection. At the second meeting individuals willing to participate were visited by the Chief Investigator, again after a training session. Their Beighton score was calculated and collected and the two questionnaires were completed. The same process was
followed with a Brighton and Hove running club and semi-professional under 21 women’s football team.

**Results**

A total of 114 participants participated, 62 men and 52 women. Running (n = 26) and football (n = 24) had the highest numbers of participants. Other sports involved; hockey (n = 19), netball (n = 17), rugby (n = 16), cycling (n = 5), tennis (n = 4), squash (n = 2) and swimming (n = 1) (see table 1). This data has also been represented as a pie chart (see figure 1).

<table>
<thead>
<tr>
<th>Sport</th>
<th>Men</th>
<th>Women</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Running</td>
<td>14</td>
<td>12</td>
<td>26</td>
</tr>
<tr>
<td>Football</td>
<td>10</td>
<td>14</td>
<td>24</td>
</tr>
<tr>
<td>Cycling</td>
<td>4</td>
<td>1</td>
<td>5</td>
</tr>
<tr>
<td>Squash</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Swimming</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Rugby</td>
<td>16</td>
<td>0</td>
<td>16</td>
</tr>
<tr>
<td>Hockey</td>
<td>11</td>
<td>8</td>
<td>19</td>
</tr>
<tr>
<td>Tennis</td>
<td>4</td>
<td>0</td>
<td>4</td>
</tr>
<tr>
<td>Netball</td>
<td>0</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>62</strong></td>
<td><strong>52</strong></td>
<td><strong>114</strong></td>
</tr>
</tbody>
</table>

Table 1 – Total participants in each sport

The overall prevalence of hypermobility was 26%. 22 women were hypermobile (42%) whilst 8 men (13%) were. Hypermobility was most common in hockey and running (31.6% and 30.8% respectively). There was a high prevalence in cycling and swimming (40% and 100%) but with limited sample size (5 and 1 respectively) (see table 2).
<table>
<thead>
<tr>
<th>Sport</th>
<th>Total</th>
<th>H</th>
<th>NH</th>
<th>H (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Running</td>
<td>26</td>
<td>8</td>
<td>18</td>
<td>30.8</td>
</tr>
<tr>
<td>Football</td>
<td>10</td>
<td>6</td>
<td>18</td>
<td>25</td>
</tr>
<tr>
<td>Cycling</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>40</td>
</tr>
<tr>
<td>Squash</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Swimming</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>100</td>
</tr>
<tr>
<td>Rugby</td>
<td>16</td>
<td>2</td>
<td>14</td>
<td>12.5</td>
</tr>
<tr>
<td>Hockey</td>
<td>11</td>
<td>6</td>
<td>13</td>
<td>31.6</td>
</tr>
<tr>
<td>Tennis</td>
<td>4</td>
<td>1</td>
<td>3</td>
<td>25</td>
</tr>
<tr>
<td>Netball</td>
<td>0</td>
<td>4</td>
<td>13</td>
<td>23.5</td>
</tr>
<tr>
<td>Total</td>
<td>62</td>
<td>30</td>
<td>84</td>
<td>26.3</td>
</tr>
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</table>

Table 2 – Prevalence of hypermobility in each sport

Of the total number of participants, 73 people had sustained an injury over the past 2 years (64%). This was defined as any occasion where an individual was unable to perform their chosen sport(s). Injuries were highest in rugby and running (75% and 73.1% respectively). All injury rates were greater than 50%, other than swimming but this category only involved one participant. The overall total number of injuries was greater amongst the non-hypermobile (NH) group. Sustaining a ligament or joint sprain was the most common injury in NH individuals (total = 38) whilst in hypermobile participants this occurred only 7 times. Sustaining a fracture was similarly common in both hypermobile and NH individuals (8 and 7 respectively. A joint dislocation troubled 3 hypermobile individuals whilst it did not affect those that were not. Other injuries accounted for 7 injuries sustained by NH individuals. These other injuries included; ligament rupture, tendonitis or simple overuse that resulted in significant pain that prevented further participation in the desired sport. One NH individual suffered a soft tissue laceration (see figure 2).

Figure 2

Fisher’s exact test was used for statistical analysis. Fisher's exact test is more accurate than the Chi Square test when the expected numbers are small. It is recommended to use Fisher's exact test when the total sample size is less than 1000 and to use the Chi-Square test when it is greater (21).
A two-tailed test was used and a two by two contingency table generated to assess whether there was a significant relationship between hypermobility and sports injury. A p value 0.74 showed that, with a 95% degree of certainty there was no statistically significant relationship between the hypermobility and injury (see table 3).

<table>
<thead>
<tr>
<th>Category</th>
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<th>Not Injured</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>18</td>
<td>12</td>
</tr>
<tr>
<td>NH</td>
<td>55</td>
<td>29</td>
</tr>
</tbody>
</table>

Table 3 – Contingency table of hypermobility and injury

There was a statistically significant relationship between sustaining a joint / ligament sprain and not being hypermobile amongst runners (p = 0.04) and all sports (0.03). This relationship was not found in any other injury group (see table 4).

<table>
<thead>
<tr>
<th>Injury</th>
<th>NH Runner</th>
<th>H Runner</th>
<th>P Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sprain</td>
<td>11</td>
<td>1</td>
<td>0.04</td>
</tr>
<tr>
<td>Fracture</td>
<td>2</td>
<td>2</td>
<td>0.56</td>
</tr>
<tr>
<td>Dislocation</td>
<td>0</td>
<td>1</td>
<td>0.31</td>
</tr>
<tr>
<td>Laceration</td>
<td>0</td>
<td>0</td>
<td>N/A</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>2</td>
<td>1</td>
</tr>
</tbody>
</table>

Table 4 – Injuries sustained in hypermobile and NH runners

Other findings identified were that:

- Most hypermobile individuals were injured for greater then 2 weeks (16 out of 18) whilst in the NH group there appeared to be a much greater distribution in duration of injury (36 out of 55 over 2 weeks).
- 23 out of 114 individuals had another medical condition, most commonly asthma (n = 15); other medical conditions included eczema (n = 3), psoriasis (n = 3) and anxiety (n = 2).
- 7 of these took regular medication, 5 individuals with asthma took inhalers, 1 took medication for anxiety and one other took an antihistamine for eczema.
- On average individuals trained twice a week.
73 out of 114 participants sustained at least one injury in the last 2 years.

Out of a total of 73 individuals that sustained at least one injury in the past two years 48 sought advice from their doctor, 28 their physiotherapist, 7 their coach, 3 their friend and 3 individuals did not seek any medical advice. (This total is greater than 73 as some sought advice from multiple specialists).

36 undertook a rehabilitation programme whilst 37 did not.

21 individuals who were injured took over the counter analgesic e.g. paracetamol. 23 took ibuprofen, and 14 took both paracetamol and ibuprofen. 3 individuals took a higher dose analgesic called tramadol and 12 people took no medication at all.

16 had a sports massage, 12 had an x-ray, 2 an MRI, 6 surgery, 37 required no further treatment.

Below is a summary of the findings amongst the under 21 semi-professional team:

14 members of this women’s under-21 team participated in this study, 4 of these were hypermobile.

10 of these had sustained an injury in the last two years whilst 4 had not.

8 of those injuries were a result of a muscle or joint sprain whilst the remaining 2 involved a fracture.

All individuals undertook a rehabilitation regime following injury and they all received treatment from the team physiotherapist, 3 also saw the club doctor.

All injuries required a minimum of 2-4 weeks away from football (40%), 50% were injured for 2 – 6 months, whilst one for more than 6 months.

All of those that were injured took an anti-inflammatory (e.g. ibuprofen) to help with the pain they experienced whilst three of these women also took an analgesic (e.g. paracetamol).

Discussion

Of the total participants 30 were hypermobile (26%) and of these 22 were female and 8 were male, 42% and 13% respectively of overall total number of participants.

The sports group that has the highest prevalence of hypermobility is in the runners and hockey players. One may hypothesis that certain sports require a greater degree of flexibility amongst joints and those that have that are more attracted to participate due to reduced rates of injury. Sustaining repeated or regular injuries in a particular physical activity can act as a deterrent and can easily lead to discouragement of further participation.
**Multi sports analysis**

This research finds no association between hypermobility and sports injury and this may be due to multi-sport analysis whereas previous papers mainly analyse single sports.

**Analysis of Injuries**

One of the commonest complaints of injuries in the runners group is a joint or muscle sprain. 19 of the runner’s sustained an injury in the past two years and 12 of these were due to a muscle or joint sprain (63%). Interestingly only one of the participants who sustained a muscle or joint sprain was hypermobile. Fishers exact test was used to determine if this was of statistical significance and a p value of 0.04 was generated. This association was found in all sports between hypermobility and sustaining a muscle or joint sprain. This suggests that being hypermobile is a protective factor for sustaining a muscle or ligament sprain in all sports.

**Hypermobility and Joint Dislocation**

Literature suggests that one of the commonest associations and complaints in hypermobile individuals is dislocation (22). When reviewing the nature of injuries in both hypermobile and NH individuals it is noticeable that only three individuals suffered a joint dislocation. Although this number is small this supports the association.

**Hypermobility and Duration Injured**

Out of 18 individuals who were hypermobile and sustained an injury 50% of these were injured for between 2 and 6 months, 39% of these between 2 – 4 weeks and the remaining for one week or less. None of these individuals were injured for longer than 6 months. However in NH individuals 11% were injured for greater than 6 months, 15% between 2 – 6 months, 40% between 2 – 4 weeks and 35% 1 week or less. Overall 50% of hypermobile individuals were injured for more than 4 weeks whilst in the NH group this was greater at 65%. One could hypothesise that NH individuals were more likely to suffer from significant injury requiring greater time away from their sport then hypermobile individuals.
Other Findings

In the literature search at the start of this project there appears to be a recognised association between hypermobility and anxiety(23). However, amongst the population involved only one individual has a diagnosis of anxiety and they are not hypermobile.

Most individuals who sustained an injury went to see their doctor and a large number of people went to visit a physiotherapist. One suspects these findings can be explained by those that were involved in club / semi-professional training teams. Their first contact is likely to be with the physiotherapist rather than the doctor as they are more closely connected to their clubs. It is interesting that some participants did not seek any medical advice and that may be due to accessibility to healthcare or health beliefs.

Pain was a common complaint in individuals following injury and 84% took a form of pain relief, either over the counter paracetamol or ibuprofen or a stronger form of pain relief (e.g. tramadol).

Analysis of Semi-Professional Football Under 21 Women’s Team

One may expect that there was a higher concentration of hypermobile semi-professional sportswomen however looking at this subgroup this does not appear to be the case and seems to reflect the prevalence in the general population. The occurrence of injury also appears to be similar.

The general duration of injury in this group appears to be greater than in the other sports and participants in this study. This may be due to the nature of football injuries and due to it being a high impact sport the injuries sustained may be more severe. All individuals who were injured took a form of medication to help with pain relief. This may suggest that medication is over prescribed in semi-professional sportspeople or it could suggest that due to regular contact with experienced health care professionals at their club there may be less of a reluctance to take medication.
Strength and Limitations

One significant limitation in this project was the lack of assessment of innate joint instability and the over-reliance on the Beighton scoring system for generalised joint hypermobility. The Beighton scoring system does not assess many joints that are involved in sports injury e.g. shoulder, hips, ankles and feet and this would need to be addressed in further work.

This project found that hypermobility was a protective factor for sustaining a joint or muscle sprain injury whilst participating in contact or non-contact sport and this relationship has not been described in other research. However, as this was a multi-sport analysis it is difficult to draw any definitive conclusion from these results.

One of the limitations to this study was the self-reporting of injury. The use of imaging would help determine and define the severity of injury e.g. in muscle sprains. Another limitation was mainly university students were involved in this study and therefore the range of ages included were limited. Most were aged 18 – 29. This may capture the most hypermobile age group as it is suggested that flexibility and hypermobility reduce with age(4). It would have been interesting to note if the association between hypermobility and sports injury differed amongst individuals or difference age groups. In addition, whether the injuries sustained were different amongst different age groups.

Recommendation for Further Work

It would be important to assess for pauci-articular hypermobility in further work and this could focus on one sport and investigate its association with sports injury in those that were hypermobile or not. It would also be important to focus on one specific joint, assessing its flexibility and association with injury. (24)

There is a possible association between joint dislocation and hypermobility. As a recommendation for further work one could perform a retrospective analysis in a population of individuals that sustained joint dislocation in sports and investigate if they were hypermobile or not. This project identifies individuals who were hypermobile are less likely to obtain muscle or ligament sprains in sport. One could hypothesise that regular stretching increase flexibility and this could subsequently reduce rates of injury.

Further work can also include focusing on one specific sports group and injuries sustained to a particular joint. The specific flexibility of that joint will also be assessed to provide more focused data for analysis. This will provide much more worthwhile data for analysis and to provide advice for injury prevention together with focusing on strength and conditioning techniques to prevent injury. Finally, a five-part questionnaire
mentioned in Juul-Kistenden et al’s meta analysis can be incorporated into initial screening (25)

Conclusion

This project found no association between hypermobility and sports injury (p = 0.66). This may be due to multi-sport analysis rather than single sports which most papers analyse. Hypermobility was found to be a protective factor for sustaining a muscle or joint sprain (p = 0.03) in all sports. Other findings were; joint dislocation was only found in hypermobile individuals and the timeframe of injury in hypermobile individuals was on average longer than NH individuals. This research provides a strong foundation for further work.

Figure Legend: -

Figure 1 - Total participants in each sport
Figure 2 - Injuries sustained in hypermobile and NH individuals
Disclosure Statements: -

- Contributorship was solely by the authors mentioned. The authors were responsible for substantial contributions to the conception or design of the work, or the acquisition, analysis or interpretation of data. In addition, the main author drafted the work and with the help of the co-authors revised it critically for important intellectual content. All authors have approved the final version and are in agreement to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

- The authors would like to acknowledge and thank all the participants in this study.

- There was no funding needed for this study.

- The authors have no competing interests to disclose.

- Ethical approval was sought by Brighton and Sussex Medical School. R&D reference 16/008/DAV. Participants in this study gave informed consent before their involvement.

- Additional data collected in this study is available and can be obtained by emailing the main author at josephnathan@doctors.org.uk.
References

Figure Legend:

Figure 1 - Total participants in each sport

Figure 2 - Injuries sustained in H and NH individuals