

# Joint hypermobility and anterior cruciate ligament injury

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## ABSTRACT

**Purpose.** To compare the rates of joint hypermobility in patients with and without anterior cruciate ligament (ACL) injury.

**Methods.** Records of 135 men and 75 women (mean age, 24.6 years) who underwent ACL reconstructions were reviewed and compared with 55 male and 35 female controls with no knee injury. Joint hypermobility was evaluated by 2 examiners using the Beighton score. The maximum score was 9, and a score of  $\geq 4$  was defined as hypermobility.

**Results.** The mean time from injury to presentation was 18 days. A non-contact mechanism of injury was more common. The inter-observer reliability was 0.7. 127 (60.5%) of the patients with ACL injury and 23 (25.5%) of the controls had hypermobility ( $p < 0.01$ ). Among them, 58% and 24% were men and 65% and 29% were women, respectively. Female gender was associated with hypermobility. Patients with ACL injury were more likely to have joint hypermobility

with an odds ratio of 4.46.

**Conclusion.** Joint hypermobility was more common in patients with ACL injury.

**Key words:** anterior cruciate ligament; joint instability; prevalence

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## INTRODUCTION

Chronic anterior cruciate ligament (ACL) insufficiency can cause damage to the articular cartilage and thus early degenerative arthritis, meniscal tears, and stretching of secondary stabilisers such as collateral ligaments.<sup>1</sup> Risk factors for ACL tears include excessive demands on unconditioned knees, knee flexion angle during landing, limb alignment, notch size, and hormonal fluctuations. Joint hypermobility is also considered a contributor.<sup>2</sup> Its prevalence is higher in females and in Africans (than Caucasians) and decreases with age.<sup>3-8</sup> This study compared the rates of joint hypermobility in patients with and without ACL injury.

## MATERIALS AND METHODS

Records of 135 men and 75 women (mean±standard deviation [SD] age, 24.6±0.90 years) who underwent ACL reconstructions between 2003 and 2010 by the senior author were reviewed and compared with 55 male and 35 female controls (matched for age and gender) with no knee injury. Patients with a history of Marfan's syndrome or Ehlers-Danlos syndrome were excluded.

Joint hypermobility was evaluated by 2 examiners using the Beighton score,<sup>3</sup> which is an edited version of the Carter and Wilkinson score.<sup>9</sup> The Beighton score has been validated and widely used in the general population.<sup>10</sup> The maximum score was 9, and a score of ≥4 was defined as hypermobility. One point was given for each positive result on each side: passive hyperextension of the fifth metacarpophalangeal joint (>90°), thumb touching the volar aspect of the forearm, active hyperextension of the elbow (>10°), active hyperextension of the knee (>10°), and placing flat hands on the floor with straight legs.

The inter-observer reliability (Cohen's kappa) was calculated. The Chi-square test was used to evaluate the difference in the rates of joint hypermobility between cases and controls. A p value of <0.05 was considered statistically significant. Odds ratios were also calculated.

## RESULTS

The mean±SD time from injury to presentation was 18±2.5 days. A non-contact mechanism of injury was more common. The inter-observer reliability was 0.7. 127 (60.5%) of the patients with ACL injury and 23 (25.5%) of the controls had hypermobility (p<0.01). Among them, 58% and 24% were men and 65% and 29% were women, respectively. Female gender was associated with hypermobility. Patients with ACL injury were more likely to have joint hypermobility with an odds ratio of 4.46 (95% confidence interval=2.58–7.71).

## DISCUSSION

Joint hypermobility as a predisposing factor for ACL injury remains controversial.<sup>11</sup> Some studies report higher rates of hypermobility in patients with ACL

injury,<sup>2,7,12,13</sup> but others disagree.<sup>14</sup> In our study, the prevalence of hypermobility was higher in patients with ACL injury than in age- and gender-matched controls.

Other scoring systems measuring hypermobility include the Carter and Wilkinson criteria, Bulbena criteria, and Rote criteria. The Beighton score is simple, easy to perform, and reliable. Most studies accept a score of ≥4 as a cut-off point for hypermobility,<sup>15</sup> which is also used most commonly in epidemiological studies.<sup>10,16</sup>

In the current study, 26% of controls had hypermobility, which was similar to that for Iraqis and Chinese, but considerably higher than that for western populations.<sup>8,17–19</sup> Asian Indians are significantly more mobile than English Caucasians.<sup>20</sup> This could be due to different cut-off scores used and the heterogeneity of different studies in terms of age and gender. The rate of hypermobility was significantly higher in women than men. This is in agreement with other studies reporting gender differences in the rates of ACL injury.<sup>4–7</sup>

Joint hypermobility may be acquired through repetitive training.<sup>21</sup> Neuromuscular training is effective in increasing performance and preventing injuries in athletes. Strong muscles stabilise the knee joint.<sup>22</sup> Training leads to superior muscle development and improved proprioception,<sup>23</sup> which may reduce strain on ligaments surrounding the joint.<sup>24,25</sup> Muscle training improves the stability of hypermobile joints and reduces the risk of ligament tears. Sports coaches and health professionals should be trained to use the Beighton score to screen individuals with hypermobility and advise them prophylactic musculoskeletal rehabilitation.

A limitation of this study was that the controls were not matched for occupation and sporting activities, despite being age- and gender-matched. Moreover, the age range of the patients was too narrow to detect differences relevant to other age groups. In addition, the 2 examiners were not blinded and may have been biased. Prospective cohort studies controlling for age, gender, occupation, sporting activities, body mass index, and ethnicity may further elaborate possible correlations.

## DISCLOSURE

No conflicts of interest were declared by the authors.

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