The relationship between hip internal rotation and groin pain in elite Australian Rules Football players.

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Abstract

A prospective study was performed in order to examine the relationship of internal hip rotation to groin pain in Australian Rules Football Players. 101 subjects were tested using a plurimeter placed on the lateral aspect of the tibia whilst lying prone on a plinth. Subjects were tested twice at an interval of six weeks and episodes of groin pain that occurred between the first and second testing dates were recorded. In players who experienced bilateral groin pain in the six week period between testing a loss of internal rotation was found. In contrast an increase in rotation was found in players suffering from unilateral groin pain. Though the degree of change in rotation was not found to be statistically significant, a definite trend was identifiable. A high rate of recurrence of groin injuries was also found. This study may have implications for the treatment and prevention of groin injuries in the athletic population and in particular Australian Rules football players.

Introduction

Diagnosis of groin pain especially osteitis pubis (OP) is an area of ongoing concern and frustration to medical practitioners in the sporting field (Andrews and Carek 1998). The incidence of groin strains and osteitis pubis consistently rose in the AFL between seasons 2000 – 2002. Each AFL club averaged an incidence of 3.9 new groin strains or osteitis pubis cases per season in 2002, compared to 3.5 new cases in 2001 and 3 new cases per club per year in 2000. In the season 2002, groin strains and osteitis pubis were second only to anterior cruciate ligament injuries in terms of number of matches missed (Orchard and Seward 2002).

First described by Beer in 1924, OP is not a new condition (Rodriguez et al 2001). In the athletic population OP was first documented by Spinelli in 1932 who noted the condition in fencers (Vitanzo et al 2001). Fricker et al (1991) described OP as groin pain that emanates from the area of the pubic symphysis including the lower rectus abdominis and upper adductors. Pain is reported during and or after exercise (particularly running and or kicking) and the most common clinical sign is tenderness on palpation of the pubic bones and or pubic symphysis. Clinical diagnosis may be supported by radiological findings on MRI such as increased signal intensity within the pubic bone marrow and irregularity of the pubic symphysis (Verrall et al, 2001). In some cases, standard AP radiographs of the pelvis will display erosion, resorption, and sclerosis of the pubic bones (Holt et al, 1995). However, in early or mild disease radiographic findings may be normal (Morelli and Smith 2001). Early diagnosis is vital and according to Vitanzo et al (2001), diagnosis of OP should be considered immediately in any active patient presenting with persistent abdominal, pelvic or groin pain. Other groin injuries include adductor strains, adductor tendonitis,

osteomyelitis and fracture of the pubic symphysis. Though considered to be of unknown etiology (Batt et al 1995), there are a number of suggested contributing factors for both groin pain and OP. One such factor is periosteal trauma which may result from a variety of causes which include direct force or microtrauma related to athletic activity (Williams et al 2000). OP may also occur as a result of infection, inflammation or injury (Fricker et al 1991) and has been associated with parturition, trauma, non-urologic surgery, urinary tract infections and arthritic disorders (Vitanzo et al 2001). For the purposes of this study we are only concerned with groin pain in the athletic population.

In a study of 59 patients, including 50 male patients presenting to sports medicine clinics having been diagnosed as having OP, Fricker et al (1991) noted that on examination men experienced tenderness over one or both of the superior pubic ramii, and had decreased hip rotation which was either unilateral or bilateral. Although the loss of internal rotation was noted the authors were not able to conclude if the loss had predisposed subjects to the condition or was a result of it. Thus the need for a prospective study as opposed to a retrospective study was presented. The authors also suggest that pelvic malalignment and sacroiliac dysfunction may play a role, but this was not investigated within this study. Highlighting the chronic nature of the condition, Fricker et al reported an average recovery time of 15 months. Morelli and Smith (2001) noted the possible implication of decreased internal hip range of motion and fixation of the sacroiliac joint as causing excessive stress on the pubic symphysis and OP as a possible sequale. Rodriguez et al. (2001) proposed shear stress at the symphysis as being capable of causing sacroiliac dysfunction in osteitis pubis sufferers if hip internal rotation is limited in either flexion or extension. As this study

was based on a single case study, however, it has poor external validity when applied to a larger population.

Gilbert et al (2001) investigated passive hip rotation in elite Australian Rules footballers. Seventy nine (79) players aged 18 – 31 years were tested in the study. The authors undertook a number of testing procedures in order to determine a reliable clinical test that, allowed for reproducibility in the clinical setting, whilst establishing normative data for the sample population. The authors found measurement of hip internal rotation to be reliable when using a method they developed based on past clinical tests. This method involved the subject lying prone in 0° of hip flexion, and measuring hip internal rotation using a plurimeter. The research concluded that the clinical test could be the basis for ongoing research into the effect of hip rotation in Australian Rules Footballers with respect to hip/groin/pelvic injury (Gilbert et al 2001).

In the aforementioned study Gilbert et al (2001) noted a significant difference in the mean values for the players who had a history of groin injury compared to those with no history of groin pain, for passive internal rotation of the hip when measured at 90^0 of hip flexion. Players with a past history of groin pain were found to have decreased ROM bilaterally, compared to those without a history of groin pain. These findings warrant further investigation. No significant difference was found when considering leg dominance of the sample population.

Though some authors refer to the influence of limited hip range of motion, the evidence appears to be anecdotal, observed during research into other possible

mechanisms rather than as primary research focused on hip internal rotation and its influence on groin pain (Fricker et al1991, Morelli and Smith 2001, Rodriguez et al 2001). They report a loss of internal rotation in one or both hips to be found in those with OP. Whether or not loss of rotation is the cause or result of groin pain is as yet unclear. This study aimed to establish whether a relationship between groin pain and hip internal rotation may exist. Limitations were also present in that none of the research into groin pain appears to describe how the limitation of hip rotation was measured. Ongoing research is required to further investigate these factors, and possibly make an impact on the prevention and management of the condition.

Methods

Participants were Australian Rules players from three Melbourne based Australian Football League clubs. Any player on the club's list who was physically capable of performing the testing procedure was included in the study, regardless of concurrent injuries. To be included in the study, players were required to be available for both testing dates six weeks apart. A total of 101 players were tested. Of those players involved in the study, the youngest was 18 years of age, and the oldest player 31 years of age. The mean age was 22.7 ± 3.52 years. Players' weight varied from 74.5kg to 120kg with a mean of 88.18 ± 9.07kg. Players filled out a questionnaire prior to first round testing. The questionnaire included a general player profile, lower limb and groin injury history, as well as current injury status. All players signed an informed consent form and the study was approved by the Victoria University Human Research Ethics Committee.

Testing was performed on two separate occasions during the AFL season. The first testing date was just after the midseason break, with the subsequent testing date being in the second last round of the season, six weeks following 1st round testing. The AFL has a home and away season of 22 rounds. Measurements were taken using a procedure adapted from Gilbert et al (2001), which were as follows:

- Participants were asked to stand comfortably with their feet hip width apart.
- The distance between the mid-points of each popliteal fossa was measured and recorded.
- A plurimeter was placed on the lateral part of each tibia, just superior to the lateral malleolus and an angle was recorded.

- Participants were then instructed to lie prone on a treatment table with their feet hanging slightly off the edge of the table.
- For the purposes of consistency, the distance between the two popliteal fossas was required to be the same when prone as it had been with the participant standing.
- To ensure the pelvis remained level during hip rotation a spirit level was placed on the participant's sacrum at approximately the level of the posterior superior iliac spines.
- Participants were then instructed to completely relax in order for the tester to passively flex the knees.
- The plurimeter was placed on the lateral aspect of the tibia before internally rotating the hips and an angle recorded at the end of passive hip rotation as palpated by the tester.
- In order to calculate total hip internal rotation, the standing angle of the tibia is added to the prone angle.

Insert Figure 1 here

Six weeks following initial testing, the tester returned to each club and performed subsequent measurements, following the same procedure. Participants were also asked at this time to verbally report any episodes of groin pain, which they had experienced since the previous testing date to the tester, who in turn recorded the information on to the survey.

Statistical analysis was performed using SPSS version 11.0. Inter and intra-rater reliabilities of the testing procedure were calculated using a Pearson Correlation. A one way between groups ANOVA with post hoc comparisons was performed in order to establish significance of the data including change in rotation on the right and left legs and changes in asymmetry between the right and left legs from the first to the second testing dates. SPSS was used to draw mean plots for easier visual analysis of the data.

Results

To enhance reliability of the results, intra and inter-rater reliability was assessed prior to testing. For the intra-rater reliabilities the sample population was taken at random from a local football team. A Pearson correlation co-efficient of r = 0.85 was reported when the above method was repeated twice on 10 players, 10 minutes apart. Inter-rater reliability was performed with another tester proficient in the testing procedure. Pearson's r was calculated at an overall value of 0.973. For this part of the study, 10 students were assessed by each tester, two minutes apart.

On the right leg, the maximum internal rotation recorded was 50°, whilst the lowest rotation was 8°. On the left leg the maximum internal rotation was recorded at 50°, and the minimum was 6°.

Insert Table 1 here

There was minimal variation in hip rotation from the general population of subjects when compared with those with a history of groin pain, or groin pain experienced between testing dates (Table 1). This represents a non significant difference.

Of the 101 subjects tested, 48 (47.5%) had previously reported a history of groin injury lasting for 3 or more weeks. During this study eighteen (18) players reported experiencing groin pain in the 6week period between the first and second measurements. In those who developed groin pain, 3 reported groin pain on the left side, 6 on the right side and 9 players experienced bilateral groin pain.

Figure 2.1 shows the change in right hip rotation from the first to the second testing date in those who had experienced groin pain. Internal rotation of the right hip decreased for those players who experienced bilateral groin pain, varied very little in those players that experienced right sided groin pain and increased by a mean of 2.33° in those with left sided groin pain.

Insert Figure 2.1 here **Insert Figure 2.2 here**

Figure 2.2 shows the difference in left hip rotation from the first to the second measurements in those players who had reported experiencing groin pain between testing dates. Those who experienced bilateral groin pain had a decrease in their left hip rotation, whilst those with unilateral right or left sided groin pain were shown to have some increase in their hip rotation. All changes were non-significant.

Insert Figure 2.3 here **Insert Figure 2.4 here**

Figure 2.4 shows the average difference between right and left hip internal rotation in those players who experienced groin pain in the six weeks between measurements, as measured in the second round of testing. Those who reported experiencing pain in their left groin, show a 5.3° variation in rotation from their left to right legs. Subjects reporting right sided groin pain had an asymmetry of 2.5° and those with bilateral pain were asymmetrical by 1.3°, this appears as a negative on the graph as the first number was smaller than the second. Subjects with groin pain in the second round of testing had a mean increase in asymmetry by almost 2° when compared to first round testing. First round measurements of asymmetry between the right and left legs are shown in Figure 2.3. The trends are very similar from the first to the second testing

date. Those with bilateral groin pain did however have a greater asymmetry on the first testing date, compared with the second. This may be indicative of asymmetry between the right and left hips having an influence on the development of groin pain.

Discussion

One hundred and one (101) participants took part in this study. Of these, 47.5% reported a previous episode of groin pain lasting for three or more weeks. This finding is consistent with other studies of groin pain in Australian Rules Footballers. One such study reported groin pain as being experienced in 45% of tested AFL subjects (Verrall et al 2001). In this study, 18 players (17.8%) experienced groin pain in the 6 week period between testing dates, 13 of the 18 had a past history of groin pain lasting 3 or more weeks. Of the 13, nine players had experienced no groin pain for more than a year prior to their current injury. This supports the high rate of recurrence reported by many including the AFL's own Injury Report. The present study suggests a recurrence rate of 72%. When taking into account players who had experienced groin pain earlier in the current season, a recurrence rate of 50% is seen. This figure is higher than what has been previously reported in other studies. There were five cases of groin pain which had developed with no prior history.

Changes in internal hip rotation over the six week period were not found to be statistically significant, though some trends can be seen. Players who experience bilateral groin pain were shown to have a loss of internal rotation in both the left and right hips. Those with unilateral groin pain had an increase in rotation in both legs regardless of which side the pain was reported on. It does however appear that the increase in rotation will be greatest on the side of the reported pain. The incidence of groin pain in the sporting population is thought to comprise between 2 and 5 percent of all sporting injuries and is more prevalent in athletes participating in sports such as ice hockey, long distance running, skiing and high jumping (Morelli and Smith 2001). It may comprise as many as 5-7% of all injuries in soccer players (Morelli and Smith

2001). Rodriguez et al (2001) also report that osteitis pubis represented 3-5% of all injuries sustained in a professional soccer team over an eight year period. These figures are similar to those reported to have occurred in the AFL injury report between 1997 and 2002 with groin strains and osteitis pubis representing between 3-4 percent of injuries (Orchard and Seward 2002). Although hip rotation has been proposed in various studies as a predisposing factor to developing groin pain across a number of sporting activities (soccer, Australian rules football, long distance running and ice hockey), it has never been formally investigated (Fricker et al 1991, Gilbert et al 2001, Morelli and Smith 2001 and Rodriguez et al 2001). There remains a paucity in the literature with respect to mechanisms of injury in the development of groin pain, especially osteitis pubis.

Some limitations exist in this study. Firstly the six week time frame between initial and follow up testing may not have been sufficient to gauge the degree of change in internal hip rotation. Given that the majority of cases of osteitis pubis were reported to occur during pre season, in future studies it would be advisable to have base line measurements performed prior to the pre season, then again before the beginning of the season proper and finally at the end of the home and away season. This would allow for a much better representation of any changes in rotation. This study focused only on hip internal rotation and its implications for groin pain. Although it is likely that hip internal rotation does play a role in groin pain and osteitis pubis, it remains a multifactorial problem and a multitude of other factors need to be clinically considered for these patients.

Conclusion

The link between groin pain and hip internal rotation remains unclear. Trends identified in this study suggest that groin pain and osteitis pubis may be influenced by hip internal rotation, however further investigation is required in order to understand the clinical significance and the reasons for bilateral groin pain being responsible for a decrease in hip internal rotation whilst unilateral pain appears to increase hip internal rotation. Ongoing research is crucial in order to broaden the current understanding of mechanisms of injury contributing to groin pain.

References

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Figure 1 – Plurimeter placed on lateral shin

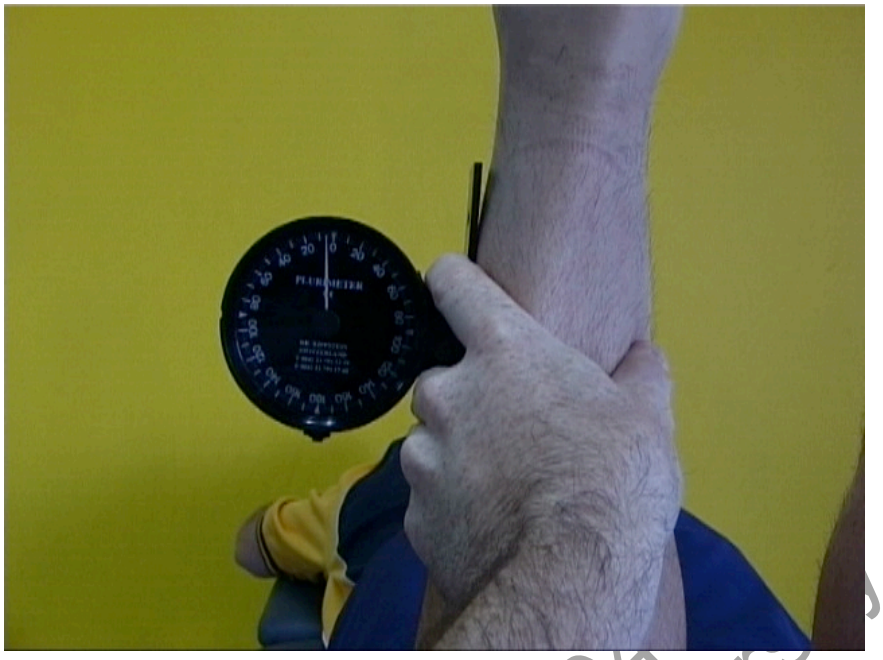

Table 1: Mean Internal Hip Rotation of Sample Population compared with those with a History of Groin Pain of Greater than 3 or more Weeks.

Mean internal hip rotation	1st Testing Date	2nd Testing Date
Right hip (all players, n = 101)	26°	27°
Left Hip (all players n = 101)	26°	25°
Right hip (subjects with >3 week history of groin pain, n = 48)	27°	27°
Left hip (subjects with >3 week history of groin pain, n = 48)	27°	26°
Right hip (players without groin pain in the 6 weeks between testing, n = 83)	25	27
Left hip (players without groin pain in the 6 weeks between testing, n = 83)	24	24
Right Hip (players who experienced groin pain in the six weeks between testing, n = 18)	30	31
Left Hip (players who experienced groin pain in the six weeks between testing, n = 18)	30	29

Figure 2.1 – Difference of Right Hip Internal Rotation between Measurements in Players Experiencing Groin Pain

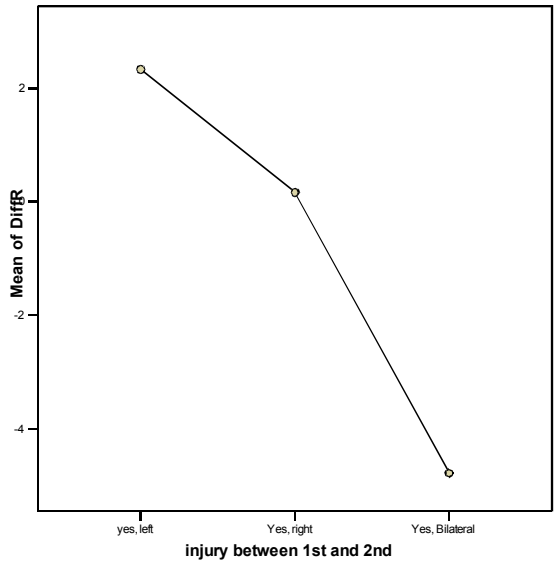

Figure 2.2 – Difference of Left Hip Internal Rotation between Measurements in Players Experiencing groin pain

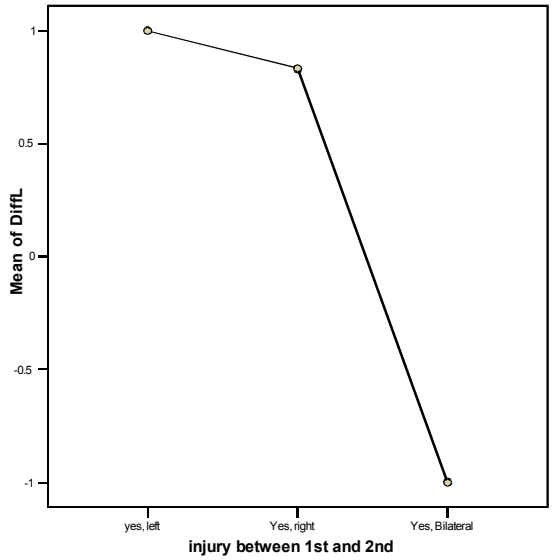

Figure 2.3 - Asymmetry between Right and Left Hip Internal Rotation Found in First Round Testing in players with groin pain

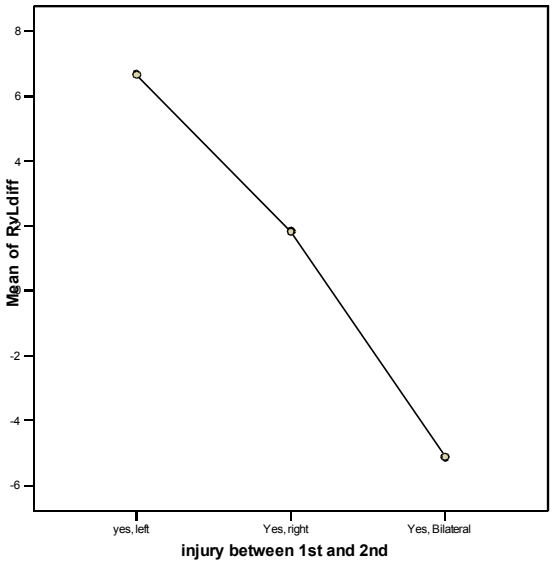

Figure 2.4 – Asymmetry between Right and Left Hip Internal Rotation Found in Second Round Testing in players with groin pain