LOWER EXTREMITY MECHANICS IN PATIENTS WITH PATELLOFEMORAL JOINT PAIN: A PROSPECTIVE STUDY

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INTRODUCTION

The knee is the most common site of injury in runners, with patellofemoral joint pain (PFP) being the most prevalent of knee pathology (Clement et al, 1986). Women have been noted to be twice as likely to experience PFP than their male counterparts. Women have also been consistently noted to have greater Q-angles. A greater Q-angle is thought to increase the lateral component of the quadriceps force vector, thereby increasing the tendency for lateral maltracking. The greater Q-angle noted in women is due to their greater hip width to femoral length ratios (Horton and Hall, 1989). This places the hip in greater adduction than males, putting females at greater risk for knee valgus as well.

These noted structural characteristics are likely to result in gender differences during movement. Ferber et al (2003) reported that females exhibited significantly greater hip adduction and internal rotation as well as greater knee abduction (valgus) during running than males. These differences could lead to abnormal patellofemoral alignment, placing females at greater risk for PFP. For example, increased knee abduction (associated with increased hip adduction) likely increases the functional Q angle and predisposes one to greater risk for patellar malalignment. In addition, femoral adduction is coupled with internal rotation. Excessive femoral internal rotation can also lead to a relative lateral malalignment of the patella. To date there are no studies comparing the 3D hip and knee kinematics of runners with PFP to that of healthy controls. In addition, while retrospective studies are informative, they do not lend insight into causative mechanisms.

Therefore, the purpose of this study was to compare, prospectively, the 3D kinematics of the hip and knee in female runners who later develop PFP to the mechanics of healthy controls who do not develop this pain. It was hypothesized that runners with PFP would exhibit greater hip adduction and internal rotation, lesser knee internal rotation (due to greater hip internal rotation) and greater knee abduction (valgus) than runners who do not develop PFP.

METHODS

These data are part of an ongoing prospective running injury study of female competitive distance runners. Female runners between the ages of 18 and 45 years and running a minimum of 20 miles per week are included in the study. All subjects undergo an instrumented gait analysis upon entry into the study. Subjects run along a 25 m runway at a speed of 3.65 m/s (±5%). Kinematic data are collected (120 Hz) with a 6-camera Vicon Motion Systems (Oxford, UK) motion analysis system. All kinematic data are filtered at 8 Hz. 3D angles of interest are calculated about a joint coordinate system using MOVE3D (NIH Biomechanics Laboratory, Bethesda, MD). Five trials were averaged for analysis. One-tailed independent t-tests were conducted on the data. Due to the

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preliminary nature of the data, an alpha of 0.10 was used for significance.

To date, 9 females have sustained PFP. All injuries were diagnosed by a medical professional. 9 healthy, uninjured females in the same study served as controls (CON). The PFP females were 33.4 yrs old (sd 8.2) and ran an average of 27 mpw. The CON were 29.9 yrs (sd 11.3) and ran 29 mpw.

RESULTS and DISCUSSION

Table 1 presents the comparison between the PFP and CON for the variables of interest. It is interesting to note that while excessive rearfoot eversion is thought to be associated with PFP, the values were identical between groups.

Table 1. Variables of interest (sd) for PFP and CON

(values in deg)	PFP	CON	p
Pk Eversion	8.7 (3.2)	8.7 (3.2)	0.50
Kn Add.	4.4 (3.2)	5.3 (3.3)	0.28
Kn IR	2.5 (5.7)	2.4 (6.9)	0.47
Hip Add	9.4 (5.4)	6.7 (2.9)	0.10*
Hip ER	5.1 (9.3)	10.2 (4.9)	0.08*
Q-Angle	16.1 (4.0)	13.0 (3.1)	0.05*

Peak knee adduction was not significantly different between groups. However, greater knee adduction excursion can be seen in Figure 1. The same is true for knee internal rotation excursion. When moving up to the hip, peak adduction was greater, as expected in the PFP subjects. In addition, the hip was in greater internal rotation at footstrike, and remained in greater internal rotation throughout stance (Figure 2).

Another interesting finding was the significantly greater Q angle noted in the PFP subjects. This structural difference coupled with the subtle kinematic differences could significantly alter the distribution of loading across the patellofemoral joint.

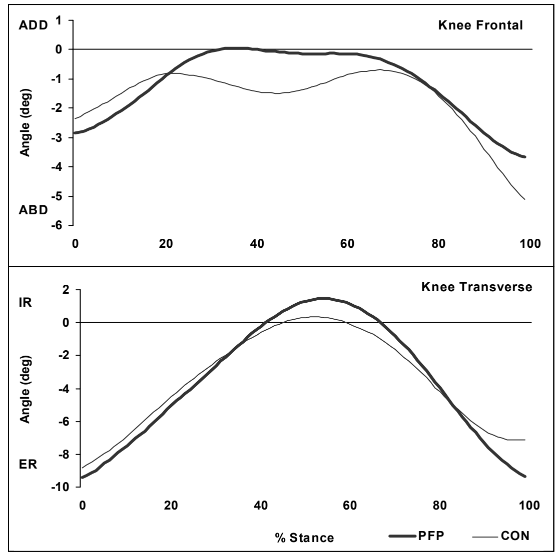

Figure 1. Knee Frontal and Transverse Motions (PFP vs CON)

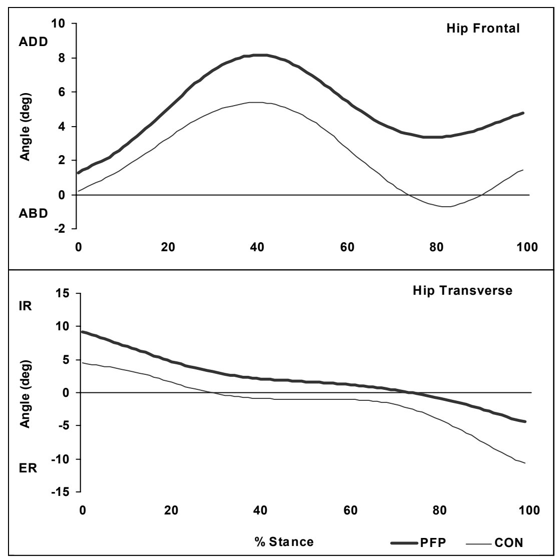

Figure 2. Hip Frontal and Transverse Motions (PFP vs CON)

SUMMARY

It is clearly difficult to infer patellofemoral kinematics and associated loading patterns from tibiofemoral kinematics. However, these preliminary data suggest there are some differences, noted prospectively, in the hip and knee mechanics of runners who develop PFP compared to those who do not. Additional differences may become evident as subjects are added to the study.

REFERENCES

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