Manual Therapy, Posturology & Rehabilitation Journal
formerly REVISTA TERAPIA MANUAL

RESEARCH ARTICLE

http://dx.doi.org/10.17784/mtprehabjournal.2015.13.291

Association between patellofemoral pain syndrome and hip morphology

Associação entre a morfologia do quadril e a síndrome da dor femoropatelar

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ABSTRACT

Background: Patellofemoral pain syndrome (PFPS) is one of the most common conditions in the knee joint, there still unclear etiology. **Objective:** The objective of this study was to investigate the association of PFPS with the morphology of the hip. **Method/Design:** For this study were evaluated 41 university students aged between 18 and 30 years divided into group with PFPS and control group, in which we analyzed the distance from the anterior superior iliac spine (ASIS), length of the lower limbs (LL) away from the patella ASIS bilaterally, lateral bending and iliac slope. **Results:** After data collection and subsequent tabulation, it was found that the group with PFPS showed contralateral iliac increase the pain (p = 0.01), moreover, was also found to the side of prevalence of pain is the side not dominant (p = 0.00). **Conclusions:** It can be inferred that there is little relationship between the morphological changes of the hip with the PFPS, as only found a side tilt of the pelvis in volunteer group that reported a previous knee pain.

Keywords: PFPS; Knee; Hip; Pelvis.

RESUMO

Introdução: A síndrome da dor femoropatelar (SDFP) é umas das afecções mais comuns na articulação do joelho, não existindo ainda etiologia esclarecida. **Objetivo:** O objetivo deste estudo foi verificar a associação da SDFP com a morfologia do quadril. **Método:** Para a realização deste estudo foram avaliadas 41 acadêmicas universitárias com idade entre 18 e 30 anos divididas em grupo com SDFP e grupo controle, nas quais foram analisadas a distância das espinhas ilíacas ântero-superior (EIAS), comprimento de membros inferiores (MMII), distância da EIAS a patela bilateralmente, inclinação lateral e inclinação ilíaca. **Resultados:** Após a coleta dos dados e conseqüente tabulação, verificou-se que o grupo com SDFP apresentou elevação ilíaca contralateral a dor (p = 0,01), além disso, também foi verificado que o lado de predominância da dor é o lado não dominante (p = 0,00). **Conclusão:** Posto isso, pode-se inferir que poucas são as relações entre as alterações morfológicas do quadril com a SDFP, visto que somente foi encontrada uma inclinação lateral da pelve nas voluntárias do grupo que referia dor anterior de joelho.

Palavras-chave: SDFP; Joelho; Quadril; Pelve.

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Financial support: None.

Submission date 3 November 2015; Acceptance date 14 January 2015; Online publication date 19 January 2015

INTRODUCTION

The knee joint is the largest and most complicated joint in the body, both from the structural and functional point of view and meets the requirements of a weight-bearing joint. Thus, it is subject to a variety of injuries which changes the performance of its function. It consists of three bony structures: femur, patella and tibia. These structures form two separate joints: patellofemoral and tibiofemoral, but because there is a mechanical relationship between the two, when it comes to function, they do not act separately.[1]

The patellofemoral pain syndrome (PFPS) can be named in several ways, such as anterior knee pain, knee extensor mechanism dysfunction, retropatellar pain, lateral compression syndrome, patellar malalignment syndrome and patellofemoral syndrome.[2,3] It is characterized by pain in general nonspecific present diffusely, with the possibility of irradiation to the popliteal region. Its onset is usually insidious, and can increase to up and down stairs, during physical activity, maintaining a prolonged period of knee flexion (movie sign) and squat position, can also be accompanied by pseudoblocks.[4]

Usually affects young adults, especially in women, occurring in 1 out of every 4 women athletes already in the incidence increases, occurring in up to 33% of the athletes. represents approximately 25% of diagnosed musculoskeletal disorders.[3,5]

The clinical presentation of patients diagnosed with PFPS is usually diffuse pain or previous retropatellar, which is exacerbated by activities such as climbing and descending stairs or sit for an extended period, squat or kneel, clicks and impairment of knee function.[3,6] Physical examination for patellofemoral research, it should be noted the alignment of the lower limbs, as varus/valgus and recurvatum or flexo, and rotational deformities of the femur and tibia and flat feet.[7]

PFPS etiology is not defined and currently it is considered predisposing factors such as the emergence of the same are: the imbalance of the extensor muscles, insufficient vastus medialis (VM), weakness of the hip muscles, excessive knee activity, the difference between the onset of muscle contraction of the VM and vastus lateralis (VL) and the incongruity between the patella.[8-11]

Additionally, there are other possible etiological factors such as pronation of the feet, high patella, genorecurvatum, genu varus, genu valgus, increased Q angle, external tibial torsion, excessive traction of the patellar tendon and retinaculum, inverted sprain ankle shortening of the gastrocnemius and hamstrings and tensioning of the iliotibial tract.[6,12]

The involvement of the muscles near the patellofemoral joint can contribute to the development of PFPS. Especially weakness of the muscles of the hip abductors and lateral rotators as they can lead to a poorer control of the frontal and transverse movements of the knee, resulting in excessive adduction and internal rotation of the femur with consequent increase of the angle Q, moreover, a bad alignment member lower during repetitive activities can cause injury to the articular cartilage retro-patellar.[3]

The abductor muscles and the hip lateral rotators when weak contribute to PFPS, as physiologically the patella is predisposed to valgus by lateralization of action suffering even in normal alignment member, so any extra force to increase the obliquity of quadriceps strength or patella tendon in the frontal plane contributes to lateralization of the patella. Concomitant to this, the femoral adduction in excess generates weakness of the hip abductor muscles, especially the gluteus medius, upper gluteus maximus and tensor fascia latae during active movement. With the weak hip lateral rotators arises internal rotation too much in support of the march and decides steps; adduction and internal rotation excess cause the Q angle addition, with this comes a overpressure at the side of the patellofemoral joint.[3]

The hip rotation for some authors influences the quadriceps activation, but there are challenges to this hypothesis. As reported by Gramany-Say[2] positions are suggested in hip rotation that activate the VM such as the squat exercise with lateral rotation of the hip; preferential activation of the vastus due to a valgus stress to the lateral hip rotation. On the other hand for Lam and Ng[13] medial rotation combined with hip extension leads to activation of the VM during squatting in individuals with PFPS.

According to Kim et al.,[14] the knee can be the site of occurrence of the painful symptoms, but the source of the problems that can trigger pain joints above or below the knee, such as the hip and ankle. Thus the treatment located in the focus of pain may be ineffective or slow, as will be dealing only the symptom without emphasis on treatment at the origin of the disease. Thus, it becomes important to know this abnormal biomechanics that may influence the patellofemoral joint, because the interventions to control abnormal kinematics of the lower limbs should not be limited to the painful area, but also cover the proximal or distal segments the patellofemoral joint.[3]

According to the precepts of the therapeutic approach in closed kinetic chain, the lumbar-pelvic-hip complex has been described a composite box by the abdominal muscles, erector spinae, gluteus, diaphragm and muscles that make up the pelvic floor and hip waist; control of this complex in PFPS is important because it acts as a core functional kinetic chain, which ensures the proximal insertion of the abductor muscles and lateral hip rotators to remain stable. It is believed that this stability would enable the generation of increased torque by these muscles during the movement and minimize the movements of the hips and the front transverse plane in activities with one foot. Some studies suggest that the decrease in muscle strength and control of the hip, especially on the adductor muscles of the hip are related to the knee joint and ankle injuries.[3]

That said,the aim of this study was to investigate the association of PFPS with the morphology of the hip.

METHODS

This study was conducted at the Universidade de Rio Verde - UniRV. It was approved by the Research Ethics Committee of the university with an opinion number 087/2010.

Forty-one academic study were included aged between 18 and 30 years. The volunteers had no associated injuries such as ligament or meniscal injuries, knee surgery or hip and were not pregnant. Volunteers were included with PFPS, without trauma to the anterior knee without neurological changes that could cause pain radiating to the knee or that affected the lower limb sensitivity (MI). Please note that to include volunteers in the group with PFPS or the control group (group without PPS) was made a little history and specific tests performed by a trained professional.

Made the inclusion of the volunteers in groups, they were educated and put clothing specific to the assessment procedure (gym clothes). At first, the subjects were in a supine position, this position they were marked with stickers markers the anterior superior iliac spine (ASIS), done that have been checked with the tape the following items: distance between ASIS, ASIS distance of the base patella (marked with pencil dermatográfico), length of the lower limbs (obtained by measuring the umbilicus to the malleolus). and asymmetry of pelvis, this piece was done using the ALCimagem® software, which verified the pelvic tilt.

Performed this step, the volunteers were instructed to remain standing, and were rebranded the ASIS, marked the posterior-superior iliac spine (PSIS) and the highest region of the iliac crest bilaterally; demarcations were made with such adhesive beads.

It was then positioned digital camera level and plumb at a distance of 3 meters of the volunteers, aligned at the time of the iliac crest of each volunteer. After that, were captured three images, the first in anterior view (Figure 1), in order to verify the pelvic tilt from the misalignment of the iliac crests, the second and the third image in right and left side view (Figure 2) in order to verify the iliac slope.

Obtained the images, they were transferred to a personal computer, in which were made the analysis of images through the ALCimagem® software, which calculates each angle from the demarcations.

Please note that the data were the investigator's possession and only the study results will be announced, followed by the ethical principles of 196/96.

For the statistical analysis we used the chi-square and Student's t test at a significance level of 95% ($p < 0.05$).

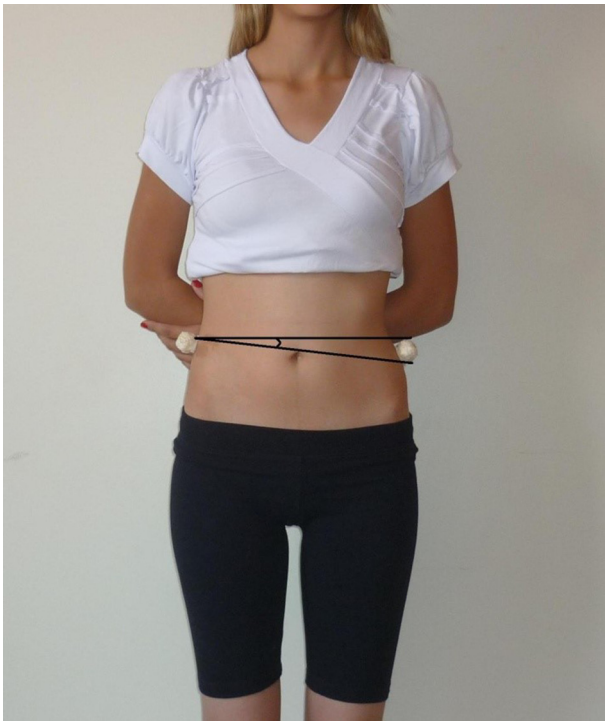

Figure 1. Side Tilt (Front view).

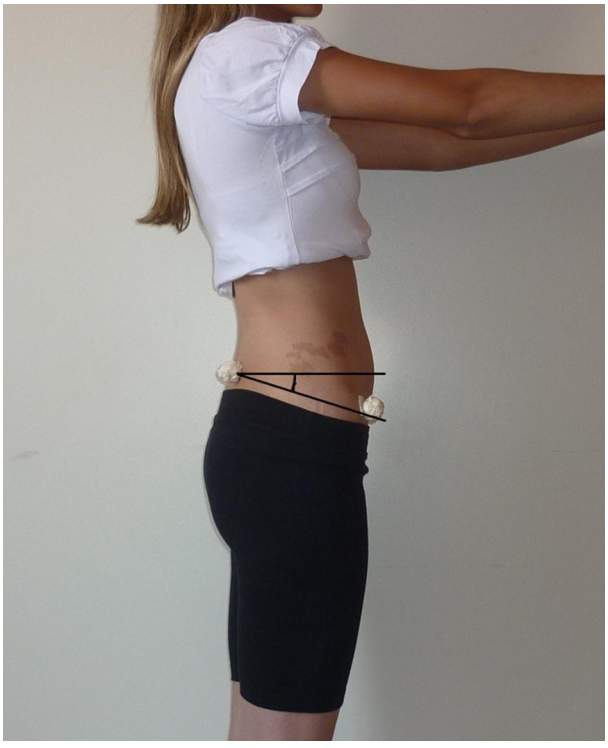

Figure 2. Iliac tilt (lateral view).

RESULTS

In the present study volunteers were divided into two groups, one group with PFPS and the other the group did not report pain (control group). The group with PFPS consisted of 22 volunteers with a mean age of 24.3 ± 5.6 years and the control group of 19 volunteers with a mean age of 22 ± 4.8 years.

The following data was obtained in the group with PFPS: Side tilt 2,74º ± 1.42, iliac tilt 4.91º ± 13,59, distance between

ASIS 25.23 ± 1.72 cm, LL right length 87.36 ± 5.31 cm, LL left length of 87.55 cm ± 5.42, distance ASIS right patella 46.5 cm ± 3.36, distance ASIS left patella 47.05 ± 3.3 cm (Figure 3).

In the control group, the results were as follows: Side tilt 1,7º ± 1.3, iliac tilt 15,2º ± 4.2 , distance between ASIS 24.6 ± 2.8 cm, LL right length 86.8 ± 4.8 cm, LL left length of 86.9 ± 4.7 cm, distance ASIS right patella 46.4 ± 2.9 cm, distance ASIS left patella 46.6 ± 2.8 cm (Figure 3).

Comparisons between groups with PFPS and control, there was statistically significant difference in lateral pelvic tilt ($p = 0.01$), understand that the group with PFPS has a greater tilt of the pelvis (pelvic asymmetry), ie the iliac crest on the side contralateral to the knee with PPS is higher. This result was obtained through the Student's t test, with significance level of $p < 0.05$.

In group with PFPS, when comparing the frequency of pain between the right and left knees, statistical significance was observed in the presence of pain in the left knee ($p = 0.006$), ie, pain in the left knee is more common than pain in the right knee, to arrive at this conclusion, we used the chi-square test.

In Figures 4 and 5 are shown respectively, the mean and standard deviation of the length of the lower limbs and the distance from the patella ASIS, both in the group with PFPS. No significant differences were found when comparing the length of the lower limbs ($p = 0.46$) and in the comparison of the distance away from the ASIS the patella ($p = 0.29$) in this group, that is, the group assessed the length of lower limbs were similar in LL with PFPS and without PFPS, as it was not detected the presence of high patellar knee with PFPS.

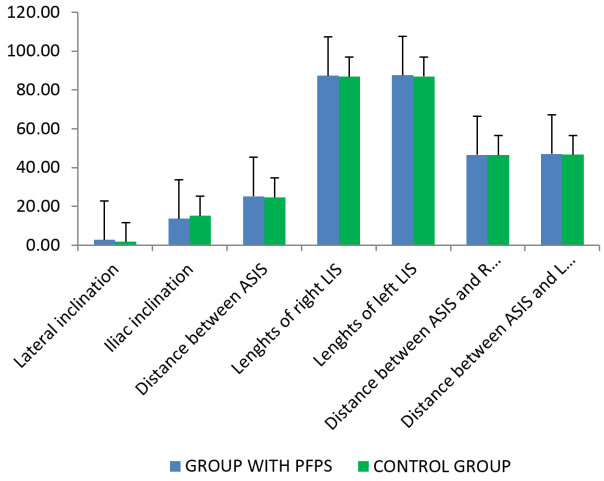

Figure 3. Mean values and standard deviation of the variables in both groups (n = 41). * $p < 0.05$.

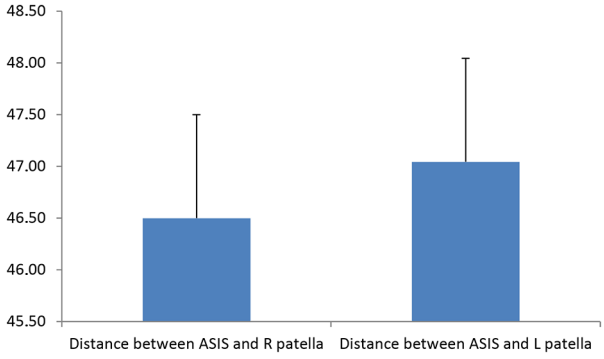

Figure 4. Mean values and standard deviation of the distance from the ASIS to the patella in the group with PFPS (n = 22).

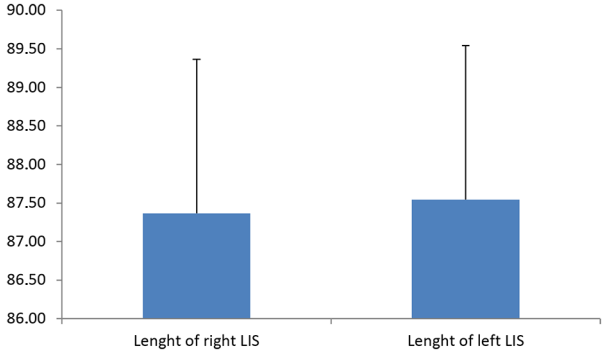

Figure 5. Mean values and standard deviation of the length of the lower limbs in the group with PFPS (n = 22).

DISCUSSION

The patellofemoral pain syndrome (PFPS) is a well studied disease, both in regard to the treatment, as to what concerns its etiology, but there are few studies that relate PFPS with any changes that may be in the hip, both in matter of muscles as a matter of bone morphology. Thus, it is a complex and conveniently search for the clarification of the etiology of such disease.

No results of statistical represented significant changes except the lateral pelvic tilt, so that the pelvis of individuals is lower on the side with PFPS compared to individuals without pain. Similarly in the present study Nakagawa et al.[15] found changes in the frontal plane pelvis of women with PFPS, the authors, similar to the present study, found that the pelvis of the ipsilateral side by PFPS is lower. According to the authors this finding may influence the torque of the abductor muscles and hip adductor, which in turn has a direct influence on patellar alignment culminating with dynamic imbalances of the patellofemoral joint.

In a systematic review of study by Lankhorst; Bierma-Zeinstra; VnaMiddelkoop[16] is well defined in the literature that changes in the Q angle, likely to occur in individuals with misalignment of the pelvis due to the change of the position of ASIS, decreased abduction strength and external hip rotators strength are directly related factors the occurrence of PFPS.

Another study also confirms these findings was Ireland et al[10] conducted a study comparing the maximal isometric strength of the abductor muscles and lateral rotators of the hip 15 female subjects diagnosed PFPS and 15 healthy subjects.; which show a decrease of 26% of the strength of the abductor muscles and 36% of the strength of the lateral rotator muscles

of the hip with PFPS group compared to the group without the disease.

Nakagawa[3] and Piva et al.[17] in separately studies with individuals with PFPS, reported that they had reduced the eccentric torque of the hip abductor muscles when compared to healthy individuals, according to the results of this work. Recently, Powers[18] pointed out the weakness of the lateral rotators and hip abductor muscles as a possible etiological factor for PFPS. According to him, the weakness of the lateral rotators and hip abductor muscles could result respectively in excessive internal rotation and hip adduction during the first phase of support of the march. In turn, the excessive adduction and internal rotation angle Q and increase the lateral patellofemoral stress, predisposing the individual to the development of pain in the patellofemoral joint.

Hall[19] complements the report that the gluteus medius is the main abductor muscle that acts in the hip, being assisted by the gluteus minimus. Both stabilize the pelvis during the stance phase of gait and running and when a person remains in one foot. If the abductors are too weak to perform its function, there will be lateral pelvic tilt.

Maragon et al.,[20] in a study of 16 women cyclists, aged 20-50 years showed that despite the average of the Q angle of the right knee pain group were higher than the no pain, was not observed statistically significant differences between groups. As for the differences between the means of the left knee Q angle with pain and no pain showed statistically significant differences. Similarly happened in this study, which was found an incidence of pain in the left knee associated with a pelvic asymmetry with elevation of the right side. These data suggest that there is a postural asymmetry induced by the dominance of one side.

Another possibility would be that the shortening of the iliotibial tract may predispose to PFPS, for their distal fibers insert in the lateral facet of the patella and, since being shortened, traction it laterally, increasing the stress on the joint.[3]

Gramani-Say[2] describes a case study of a patient of 15 years old, female, with the PFPS associated with atypical pattern of decreased internal rotation of the hip, weakness of muscles medial rotators and abductors member of the hip less affected. These findings also reflect the muscle imbalance and possible changes in the positioning of bone structures, since as explained before there is an intimate and inseparable relationship between muscle function and placement of structures that serve as attachment points of the muscles.

According to the holistic thinking of the muscles, the complex lumbar-pelvic-hip is a box composed of the abdominal muscles, erector spinae, gluteus, diaphragm and muscles that make up the pelvic floor and hip waist; control of this complex in PPS is important because it acts as the center of functional kinetic chain, which ensures the proximal insertion of the abductor muscles and lateral hip rotators to remain stable. It is believed that this stability would enable the generation of increased torque by these muscles during the movement and minimize the movements of the hips and the front transverse plane in activities with leg support.[3]

The evaluation of the knee joint adjacent is essential for planning and subsequent treatment efficacy. In particular the assessment of hip to be relevant as shown in the systematic review by Peters; Tyson,[21] which concluded that interventions in the proximal joints to provide knee pain relief and improved function in the short and long term and, therefore, physical therapists should consider the analysis and the use of interventions in these overlying joints for treatment of patellofemoral pain.

CONCLUSION

Through the study, with the studied sample, one can reach the conclusion that this voluntary group studied were observed minimal relation between morphological changes of the hip with the PFPS, because through the analyzes was noted only the presence of slope side of the pelvis on the right side associated with an incidence of pain in his left knee in volunteer group that reported a previous knee pain.

Thus, we suggest further studies on the relationship of the asymmetry of the pelvis associating with the contralateral knee pain before presenting a larger sample.

AUTHORS CONTRIBUTION

EGMS: elaboration of the article, SBN: data collection and search for articles to manuscript, HMS: orientation and elaboration.

COMPETING INTERESTS

The authors declare no conflicts of interest.

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