Comparison between the Dominant and Non-dominant Sides of Athletes with Groin Pain*

Comparação funcional entre membro dominante e não dominante em atletas com dor inguinal

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Abstract

Objective To compare the difference in range of motion (ROM) between the dominant and nondominant hips of the athletes and to correlate the results with groin pain, as well as to compare the differences in ROM among the main hip injuries.

Methods The participants included 75 athletes, 56 males and 19 females, aged between 20 and 46 years old, who were diagnosed with hip injury. These individuals were subdivided according to the pathologies (femoroacetabular impact or labral lesion, adductor and pubic lesions and trochanteric syndrome) and characteristics of each hip were analyzed.

Results A total of 150 hips (right and left) were measured for the present analysis. When comparing the ROM of the injured hip with the healthy hip, no statistically significant differences were found. There were also no significant differences between the amplitudes of hip movement when the main pathologies were compared.

Conclusion The present study did not find differences in ROM rotation between the various pathologies of the hip.

Keywords

- athletes
- pain
- hip
- hip injuries

Resumo

Objetivo Comparar a diferença do arco de movimento (ADM) entre o quadril com lesão e o não lesionado de atletas com as principais patologias femoroacetabulares. Além disso, analisar a diferença da ADM do quadril em cada patologia considerada.

Métodos Os participantes do presente estudo foram 75 atletas de diversas modalidades esportivas, sendo 56 mulheres e 19 homens, com idades entre 20 e 46 anos, os quais tinham diagnóstico de lesão do quadril. Esses indivíduos foram subdivididos em três grupos de acordo com as patologias (impacto femoroacetabular ou lesão labral, pubalgia ou lesão dos adutores e síndrome trocantérica) e as características de cada quadril foram analisadas.

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Resultados Um total de 150 quadris (direito e esquerdo) foram mensurados para a presente análise. Comparou-se o ADM do quadril lesado e do quadril saudável de cada atleta e não foram encontradas diferenças estatísticas. Da mesma forma, não houve diferença significativa entre a ADM do quadril entre as principais injúrias.

Conclusão O presente estudo não encontrou diferenças no arco de movimento entre o quadril lesionado e o contralateral, bem como não houve diferença na amplitude dos movimentos entre as patologias femoroacetabulares analisadas.

Palavras-chave
- atletas
- dor
- quadril
- lesões no quadril

Introduction

The hip is a joint of high anatomical and biomechanical complexity, which makes it difficult to identify injury-related factors and accurate diagnosis.[1,2]

Sports-related musculoskeletal injuries are more common in athletes from modalities involving several lateral dislocations, sudden changes in direction, abrupt accelerations and decelerations, and kicks.[3] Symptoms may range from transient discomfort to severe chronic pain, and even terminate the career of some athletes.[4]

The most common conditions in the hips of athletes include adductor muscle injury (ranging from 10 to 18%)[5,6] groin pain (2 to 5%),[7,8] femoroacetabular impingement signs (around 95%)[9] and trochanteric syndrome (2.5%).[10]

There are several risk factors for these injuries, including possible hip rotation asymmetry. Studies have shown that normal individuals present symmetric hip internal and external rotation range of motion (ROM),[11] whereas patients who recover from hip pain have a higher ROM than those who remain symptomatic.[12] Thus, a growing number of studies suggest that asymmetry and limitation of femoroacetabular joint ROM are risk factors for chronic inguinal pain in athletes.[13]

Limited hip joint ROM is noted in athletes with pubic osteitis and pubic bone stress fracture, also suggesting a relationship to adductor muscle injuries.[14] Other studies show that subjects with asymmetrical hip rotation also had adductor muscle weakness, usually when the difference between external and internal rotation in a given side was $>15°$. This movement limitation probably results in loss of strength and, if associated with vigorous activities requiring sudden rotation and lateral dislocation, physical contact and kicking, may contribute to the onset of symptoms.[15]

As such, the main objective of the present study was to compare hip joint ROM in athletes diagnosed with groin pain, trochanteric syndrome or femoroacetabular impingement and to analyze the mobility restriction generated by each condition. In addition, the present study aimed to compare the ROM in injured and uninjured hips of each athlete.

Materials and Methods

Medical records from patients seen at the Hip Ambulatory from our Sports Traumatology Center between 2008 and 2016 were analyzed. The inclusion criteria were the following: subjects with a medical diagnosis of specific hip injuries (femoroacetabular impingement, labral lesion, groin pain, adductor muscle injury and trochanteric syndrome) established by clinical examination associated or not, as required, with complementary tests (radiography, ultrasonography or nuclear magnetic resonance [NMR]) and which were evaluated by our physical therapy team.

Subjects with referred low back pain and sacroiliac joint pain, previous fractures and osteoarthrosis were excluded, as well as those with no physical therapy evaluation or medical diagnosis. Information from personal history, physical examination and questionnaires were tabulated and analyzed to find data related to some specific lesion type. This information included age, gender, medical diagnosis, injury mechanism (traumatic or atraumatic), internal and external rotation ROM, and Harris Hip Score.

A total of 133 medical records were evaluated, of which 44 were excluded due to the lack of physical therapy evaluation or complete medical diagnosis. The remaining 89 records included 14 with diagnoses that did not fit the study proposal, such as osteoarthritis, femur fracture and muscle injuries (rectus femoris muscles, hamstrings), which were excluded. The final sample consisted of 75 subjects, 56 males and 19 females, with a mean age of 33.16 years old ($\pm$13.01), including 22 patients with femoroacetabular impingement or labral injury (GROUP 1), 36 with groin pain/adductor muscles injury (GROUP 2) and 17 with trochanteric syndrome (GROUP 3).

A 20-cm goniometer (Carci, São Paulo, SP, Brazil) was used for hip joint measurements. Subjects were positioned sitting on the edge of a stretcher, with the thigh supported; both the hip and knee joints were flexed at 90°. The stationary arm of the goniometer was aligned perpendicular to the ground and the movable arm was aligned with the tibial axis. The hip was passively moved in internal rotation and then in external rotation until the detection of the joint capsule final sensation. To measure hip flexion, subjects were in supine position, with the fixed arm of the goniometer parallel to the ground, in the axillary midline, and the movable arm aligned with the femoral axis. For extension measure, subjects were in prone position, with both goniometer arms positioned as for the flexion measurement. Tests were performed by three different physical therapists at random, according to the day of visit and their work schedule. Measurements were

performed three times for each movement of each hip and their mean was calculated.

The 75 subjects from the study included 30 who played soccer, 9 who practiced athletics, 8 who fought karate, 7 who played handball, 6 who were swimmers, 4 who were ballerinas, and 4 who were cyclists.

Statistical Analysis

Descriptive analysis was initially used for anthropometric measurements. The Kolmogorov-Smirnov test verified data normality. Next, analysis of variance (ANOVA) was used to compare the hip ROM between groups. Intragroup analysis used the Tukey post hoc test. Paired T-tests verified differences between injured and uninjured limbs within each group. Analyses were made in SPSS Statistics for Windows, Version 17 (SPSS Inc., Chicago, IL, USA) with a significance level of 5% ($p \geq 0.05$).

Results

There was no significant difference between groups regarding injured and noninjured hip ROM and functionality level at the Harris Hip Score ($p > 0.05$) (►**Table 1**). Moreover, in the evaluation of each subject, there was no difference at the ROM from painful and contralateral joints. The values obtained are shown at ►**Table 1**.

Discussion

The present study found no difference in hip ROM between groups or injured and noninjured limbs within each group, as expected according to some studies found in the literature. Ibrahim et al[12] showed that ROM limitation may be associated with hip injuries, although the mechanism involved is not clearly described. Fricker et al[16] described a mechanism in which the femoroacetabular joint undergoes inflammation and scarring as part of an overuse syndrome, similar to the frozen shoulder triggered by a rotator cuff injury. Whether due to vascular deprivation of pelvic structures or inflammation foci at the hip, the resulting stiffness is a manifestation of reflex spasm of the hip rotator, flexor, and adductor muscles. These changes may explain why rotation limitation, pain at hip mobilization, and adductor weakness occur after adductor muscle injury. Hip rotation returns to its preinjury ROM when the acute phase ends. This mechanism, although not entirely clear, includes aggressive rehabilitation, rest and removal of pain causes. This reduced ROM, either due to inadequate rehabilitation or lack of treatment, may characterize a risk factor for adductor muscle injury. Some studies show that the adductor muscles act as internal hip rotators when in extension.[17] This adductor contraction against a rigid capsule may be another cause for muscular injury.[12] Williams[18] described that sports activities such as soccer require a free internal hip rotation ROM, either in flexion or extension. Thus, when this movement is limited, stress is applied through the joint to the contralateral hemipelvis, triggering other symptoms, such as groin pain.

Although a hip ROM limitation is not described as a risk factor for trochanteric syndrome, the authors expected to find some type of change in this group, since its major cause of lateral hip pain involves an alteration (tendinopathy) of the gluteus medius and/or minimus muscles,[19] which are the main hip abductors and also its rotators.

In the group diagnosed with femoroacetabular impingement and labral lesion, hip ROM changes were also expected because the inappropriate contact between joint structures would limit mobility; from a different perspective, the ROM could be greater, resulting in impingement. Even in subjects with unilateral symptoms, no significant difference was observed when compared with the uninjured side. Most subjects with labral injury presented signs of impingement, as described by Burnett et al,[9] which was responsible for these lesions. However, labral lesions may also occur due to

Table 1 Range of movement in the hips of athletes

	GROUP 1	*p-value* GROUP 1	GROUP 2	*p-value* GROUP 2	GROUP 3	*p-value* GROUP 3	*p-value* groups (ANOVA)
RI LL	34.9545 (±13.86835)	0.341	36.2222 (±10.02030)	0.335	34.1765 (±12.12041)	0.953	0.822
RI LNS	36.3636 (±11.23577)		35.0833 (±9.06918)		34.0588 (±10.12096)		0.770
RE LL	40.9091 (±14.75162)	0.300	40.1111 (±12.37689)	0.981	36.7647 (±12.77463)	0.579	0.592
RE LNL	42.8636 (±13.29982)		40.0833 (±13.13746)		35.7059 (±11.79388)		0.234
ROM TOTAL LL	75.8636 (±24.90036)	0.132	76.3333 (±16.91660)	0.432	70.9412 (±21.04302)	0.640	0.652
ROM TOTAL LNL	79.2273 (±20.28119)		75.1667 (±17.72569)		69.7647 (±19.26632)		0.305
HARRIS HIP SCORE	70.5909	0.454	71.4722	0.454	67.5294	0.454	0.477

Abbreviations: ANOVA, analysis of variance; GROUP 1, femoroacetabular impingement and labral lesion; GROUP 2, groin pain and adductor muscles injury; GROUP 3, trochanteric syndrome; LL, injured side; LNL, noninjured side; RE, external rotation; RI, internal rotation.

excessive external hip rotation due to atraumatic hip instability, with or without mechanical impingement.

Focal rotational instability is defined by a localized laxity of some capsular-ligament structures resulting from repetitive hip rotation forces.[20] Therefore, we hypothesized that these subjects would present some ROM changes, especially in external rotation, but this was not the case.[20]

As mentioned earlier, our results are inconsistent with some studies in the literature suggesting a relationship between hip ROM limitation and joint injuries. The present study has limitations that may have influenced the results. The first limitation lies in the evaluation of the subjects, because despite the positional standardization adopted by the physical therapy team (patient sitting down for rotations and in dorsal and ventral recumbency for flexion and extension, respectively), the evaluators were different, which may lead to measurement variations. In addition, another important consideration regarding the group with femoroacetabular impingement and labral injury is that the contact between structures usually occurs in hip flexion, internal rotation and adduction; the evaluation, however, was made with subjects sitting down, with the hip in neutral position for abduction/adduction, which is not consistent with the condition. The second limitation of the study is the heterogeneity of the sample, which consisted of athletes of different genders, ages and sports; these data influence hip ROM, as shown by Roach et al.[21] These variants are so important that there are studies demonstrating consistent results regarding hip ROM in baseball players. Picha et al[22] showed that baseball players aged between 7 and 11 years old have greater internal rotation than those aged between 12 and 18 years old. Overall, the main leg had more internal rotation than the supporting leg. However, no difference in external hip rotation was observed between age groups, player positions or hip side. These findings may be explained by the increased mobility and ligament laxity in the younger age group because this population tends to have more elastic tissue than the adult population.

Another study[23] evaluated hip joint ROM as a risk factor for hip, abdomen and groin injury in professional baseball players. This study found correlations between decreased hip internal rotation and total ROM with hamstring injuries. Assessing the hip according to players position, catchers and pitchers had significantly decreased hip ROMs compared to field players.

Divergent results are due to the inherent differences in sport, age, gender and position of the athlete. Mosler et al[24] examined hip strength profiles and ROM in 394 asymptomatic male professional soccer players. As in the present study, they did not observe clinically relevant differences between the dominant and nondominant leg in these measures.

As for different results in relation to gender, Cheatham et al[25] evaluated hip ROM in recreational weight training participants. When these authors compared hip ROM values between genders, men showed no significant difference between the right and left hips in all movements. On the other hand, women had a significant difference between right and left hips in all movements. Hip ROM was lower in men compared to women.

Although we did not consider sports modality, Kouyoumdjian et al[26] showed that activities including gyrus do not influence hip rotation alteration. Moreover, the influence of the sport practiced is difficult to interpret in a population mostly consisting of amateur athletes.

Although our study shows no difference in hip ROM comparing injured and noninjured sides, this type of alteration must not be excluded as a risk factor for hip injuries. Cibulka et al[15] showed that the strength of the hip rotator muscles decreased when the difference between the external and internal rotation of the injured limb was $\geq 15°$. This weakness caused by ROM changes associated with activities requiring hip joint stability and power, such as pivots and abrupt accelerations/decelerations, may be a risk factor for articular structures.

In a prospective study, Verrall et al[27] also observed that hip ROM asymmetry precedes the onset of chronic inguinal pain and may be considered a risk factor for this condition.

In addition, Harris Hip Score results did not indicate significant functional change between groups; as such, it was not possible to assess whether one type of injury was more disabling than another. The lack of classification or grading of intragroup lesions at the medical diagnosis, disregarding their extent and severity, difficulted their comparison.

Conclusion

The present study found no differences in ROM from several hip conditions. However, this relationship should not be excluded as a possible risk factor for injuries due to the limitations of the present study, which must be corrected in further researches.

Conflict of Interests

The authors have no conflict of interests to declare.

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