17 - BALANCE HAMSTRINGS/QUADRÍCEPS ON SUBJECT WITH TOTAL RUPTURE OF ANTERIOR CRUCIATE LIGAMENT

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Introduction

Since the concept isokinetic published by Hislop and Perrine in 1967, relations of torques of muscle hamstrings and quadriceps (Hams/Qds) of the knee have been studied with great interest. To Terreri *et al*. (2001) the relationship Hams/Qds is an important parameter in the proper conduct of the practice of sports and are considered the only appropriate way to obtain information about the existence of proportion antagonist / agonist and thus the balance muscle.

The peak torque of each muscle group occur at different angles of articulation (Deffner et al., 1998). The corresponding angles of these relations, the time-relations angle and time-angular velocity of the flexors and extensors of the knee, are necessary elements to consider when trying to assess the balance of force on the knee. Thus, the calculation of the value of the relationship Hams/Qds through the peaks of maximum torque generated during contraction dynamics would not be physiological, because this type of assessment could not adequately represent the relationships force-length and strength-speed (Hiemstra et al.,2004).

The literature has found some studies that assessed the relationship Hams/Qds at different angles of flexion of the knee (Deffner et al., 1998; Aagaard et al., 1998; Aagaard et al., 1995; Westing et al., 1989; Murray et al., 1984). These studies confirmed that the values of respect for Hams/Qds are highly dependent on the angle of the knee joint in which the measurement is made. However, until this date have not been found studies that assess the balance muscle in the range of 30 ° and 15 ° of flexion, in which the injury of the anterior cruciate ligament (LCA) happens commonly. This range of motion there is an increase in tension of the LCA, especially at 15 ° of knee flexion, which is, generally, the position of the knee injury during the LCA (Olsen et al. 2004; Beynnon et al., 1995; Beynnon et al., 1992).

Given these considerations, this study was designed to evaluate the relationship Hams/Qds the amplitudes of 30 and 15 during the contraction dynamics Concentric in subjects with unilateral rupture of the LCA.

Methods and materials

Subjects were evaluated sixteen (16) with the male gender with total rupture anterior cruciate ligament unilateral, which practiced some form of recreational sport, and that all injured during practice sports. This study was approved by the Ethics Committee of University San Marcos, and before the involvement of the term free and informed consent was obtained from each of the volunteers participating.

The average age of the sample was 33 ± 8.6 years old, height of 178.7 ± 4.4 cm, body mass of 86.1 ± 12.84Kg, BMI of 27.4 ± 3.64 and time of injury 5 ± 4.5 months. In this sample 12 subjects had meniscus injury associated. Subjects were excluded who had another type of injury associated as: limiting or blocking of the extent articulate; Reconstruction of contralateral LCA; Partial or total collapse of the contralateral LCA; The cartilage lesion above Grade II of articulation femoropatelar or femoro-tibial; Osteoarthritis of articulation bilateral knee; past history of surgery or disorders of the lower limbs, hip and spine.

The injury was diagnosed as LCA from the clinical examination by a physician and surgeon specializing in knee confirmed by examination through complementary magnetic resonance. After confirmation of the diagnosis the subjects were referred to isokinetic evaluation.

Before the completion of isokinetic evaluation, the subjects performed warming muscle in a ergometric bicycle by 10 (ten) minutes without charge. Then place a series of thirty seconds of static stretching of the muscles hamstrings, sural triceps and quadriceps.

To isokinetic evaluation, the subjects were placed in the chair of the dynamometer isokinetic according to the manufacturer's guidelines isokinetc REV 9000 (Alameda ®, savage, Italy), with the mechanical axis of rotation aligned with the lateral femoral epicondyle. The subjects took the sitting position (with 90 ° of flexion coxofemoral) and were stabilized by strapping in the chest and pelvis to prevent the movement of the body and the compensatory hip. The establishment of a lever arm was positioned in the distal portion of the leg above the apex side. Before the test received guidance on the procedure and had the incentive only the visual feedback and encouragement verbal applied by the same assessor.

Five were performed repetitions of familiarizing the equipment, speed and position, and subsequently, 5 concentric repetitions of flexo-extension of the leg speed 60°/s within the range of motion articulate of ninety degrees of flexion at zero degree of extension of the knee. It was evaluated the relationship Hams/Qds, every member on 15 and 30 degrees of flexion of the knee and throughout the range of motion. Evaluated is the first member without injury, control group, and later with the injury. Standardized express themselves through the torque muscle in the percentage of body mass of the individual.

It was conducted on descriptive statistics (percentage, average, the standard deviation and asymmetry of the normal curve) to investigate the characteristics of the variable studied. The Shapiro - Wilk test showed that the relationship Hams/Qds not had normal distribution. It used the Mann-Whitney test to compare measurements of the relationship Hams/Qds independent of the angle, in the ranges of 15 ° to 30° of flexion, among members involved and not involved. It was adopted a level of significance of 5% ($\lambda = 0.05$), and statistically significant tests with $p < 0.05$

Results

In Table 1 shows the average, standard deviation, minimum and maximum value of relations Hams/Qds independent of the angle, 30 ° and 15 ° of knee flexion member with the total rupture of the LCA and without injury, separately.

In reviewing the results at the speed of 60 °/s, it was observed that the value of the relationship Hams/Qds independent of the angle and the amplitudes specific, the State submitted a relationship injured highest that the State does not injured. By comparing the ratio Hams/Qds independent of the angle and the magnitude of bending 30°, obtained a significant difference at $p = 0.001$; and in 15° of flexion, $p = 0047$ (Table 1).

Discussion

The results of this study have shown significant difference in the relationship Hams/Qds between the member with and without injury of LCA, both in the range of 15 ° and 30 ° of flexion of the knee joint and regardless of the angle articulate. St Clair Gibson et al. (2000) to compare the relationship of eccentric Hams/ Qds, found significant differences between members with and without disabilities. However, when analyzing the relationship of Concentric Hams/Qds, the State without lesion was 65% and 71%

of injury, no significant difference between processing members with and without injury. The disagreement with the outcome of this study, perhaps, can be explained by selection of the sample, because he selected individuals with more than a year of injury, of which 42% had the time of injury more than 10 years, moreover, 11 % mechanisms of injury were counted by the sport and 11% in automobile accidents. While, in our study were selected individuals who suffered ligament rupture with the mechanism of injury without counted, with minor injury time of 15 months.

Kannus et al. (1988) to analyze the relationship Hams/ Qds in subjects with injury of lateral collateral ligament in grade II and grade III, which had a relationship Hams/ Qds not injured in the State of 60%, and the injured member of 68%, showing no significant difference. It has been noticed by Terreri et al. (1999) to evaluate the professional athletes with average time of the injury LCA of 10 months, which have been subjected to treatment to the injury, found that the relationship Hams/Qds side with injury was 60% and 57% of without injury, no statistically significant difference.

The odds of the results of this study compared to Terreri, et al. (1999), might be explained by the fact that subjects were evaluated by Terreri undergoing rehabilitation, thus balancing the relationship Hams/Qds. Meanwhile, there are reports that the rehabilitation of the injury subject with the same LCA presenting appropriate degrees of muscle balance can experience episodes of perpetuation of instability in the knee (Harilainen et al., 1995; Murray et al., 1984), perhaps due to muscle imbalance presented in the early degrees of flexion. Thus motivated is to analyze the relationship Hams/ Qds in 15 ° and 30 °, which found that the State presented with a larger lesion that without injury. It could be explained through the concept of the existence of hypotrophy of the quadriceps muscle reflex caused by the inhibition of muscle, mainly in the degrees last long, and perhaps by increasing the sensitivity of miotatic hamstring in an attempt to offset the imbalance static and dynamic after the rupture of LCA (Raunest, 1996).

Whereas the quadriceps is antagonistic and hamstring are sinergista of LCA, the increase in relation hams/ Qds is beneficial to good stability articulate, although not beneficial to the subject, thus limiting their daily activities, such as sports practice, jump, run, walk, climb and descend stairs, kneeling, crouch, sitting with the knee bent, bend, get up from a chair, in the act of uprooted and stop fast, and support involved in the leg.

Lesions of stabilizers static, as the complex ligament, can damage the function stabilizer or dynamic segment of muscle / tendon. The subjects with injuries of ligaments, as a total rupture of the LCA, it is often restricted in their physical activities. Since such subjects are injured by situations involving pain, swelling, muscle hypotrophy, instability, and the limitations on the movement of articulation, your activity becomes limited and develop the muscle imbalance, which can then lead to a disproportion between the muscle antagonist / agonist (Terreri et al., 1999).

Faced with these considerations, there is need for further investigation using, in addition to the isokinetic dynamometer, other instruments that can help in clarifying the behavior of the relationship Hams/Qds these amplitudes. It would be interesting studies that were conducted with a sample more homogeneous with respect to the time of injury and no injuries linked to that may come to interfere in the generation of measurements of parameters, such as peak torque, relationship antagonist / agonist, muscle power, and others.

Conclusion

The results of this study indicate a significant difference in the comparison of the relationship Hams/Qds independent of the angle, 15 ° and 30 ° of knee flexion. Thus, even those individuals with total collapse of the LCA submit a Hams/Qds independent of the proper angle, may have the last degrees of flexion significant deficits in the balance muscle damaging the functional capacity of the link to perform daily activities and sports. So it appears that when adopting the value of peak torque of the extent articulate on 15 and 30 to calculate the ratio flexor / extender in subjects with rupture of the LCA, and best way to check the stability articulate because it is the last 30 ° flexion of the LCA is required to control the stability articulate.

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BALANCE HAMSTRINGS/QUADRÍCEPS ON SUBJECT WITH TOTAL RUPTURE OF ANTERIOR CRUCIATE LIGAMENT

ABSTRACT

This study was designed to evaluate the relationship hamstrings/quadriceps in the ranges of 30 ° and 15 ° of flexion during contraction dynamics Concentric in subjects with complete rupture of the anterior cruciate ligament (LCA) unilaterally. Subjects sixteen (16) were evaluated with the male gender average age of 33 years and average time of injury 5 months. For evaluation isokinetic dynamometer was used isokinetic REV9000. The subjects were placed in the unit in accordance with the guidelines of the manufacturer. The test was conducted isokinetic with five repetitions in speed 60 °/s, in concentric manner. The parameter studied the relationship was hamstrings/quadriceps independent of the angle, 15 ° to 30 ° of flexion. It was done with a heating prior ergometric bicycle, stretching the quadriceps and hamstrings, and adaptation with five repetitions sub maximal in the unit. Standardized first assess the member without injury and later with the injury. The processing of the data was performed using the Mann-Whitney a test using a significance level of 5% (= 0.05). The results indicate significant difference when comparing the relationship hamstrings / quadriceps independent of the angle and scale of 30 (p = 0.001), and 15 of flexion of the knee joint (p = 0.047) of the injured member with the State without injury. It follows that when you take the value of peak torque of the extent articulate on 15 and 30 to calculate the ratio flexor / extender in subjects with rupture of the LCA, and best way to check the stability articulate.

KEY WORDS: Relationship Hamstrings/ Quadriceps, total rupture of the anterior cruciate ligament, isokinetic.

ÉQUILIBRE ISCHIO-JAMBIERS/QUADRICEPS DANS DES SUJETS AVEC RUPTURE TOTALE DU LIGAMENT CROISÉ ANTÉRIEUR

RESUME

Cette étude avoir comment objectif évaluer l'relation ischio-jambiers/quadriceps dans les amplitudes de 15° et de 30° de de flexion durant l'contraction dynamique concentrique en individu avec rupture total du ligament croisade antérieur (LCA) inégal. Aller évalue 16 sujet du sexe masculin, avec âge moyen de 33 ans e avec temps médis de lésion de 5 moises. Pous évaluation isocinétiques a été utilisé dynamomètre isocinétique REV9000. L'individu aller se placer d'accord avec l'orientation du fabricant. Le test isocinético réalise avec cinq dans vélocité 60°/s, nu manière concentrique. L' paramètre étudié a été l'relation ischio-jambiers /quadriceps indépendant de l'angle, en 15° e 30° de flexion. Ce a été réaliser un chauffage précédent avec bicyclette ergométrique, allongement du quadriceps e ischio-jambiers, adaptation avec cinq répétition submaximas nu appareil. Standardiser évaluer premier l'membre sans lésion e avec l'lésion. L'traitement de les donnés foi faite por l'test Mann-Whitney, employer l'niveau d'importance 5% (=0,05). Les résultats indiquer une différence significatif à comparer l'relation ischio-jambiers/quadriceps indépendant de l'angle e na amplitude de 30° (p=0,001), e 15º de flexion d l'articulation de l'genou (p=0,47) de l'membre avec lésion avec l'membre sans lésion. Conclue que à t'adopter l'valeur de pic de couple monteur de l'amplitude articulaire dans 15° et 30° pour calculer l'relation flexor/extenseur dans individu avec rupture du (LCA), et la meilleur manière pour t'vérifer l'stabilité articulaire.

MOTS-CLES: Isocinétisme, relation ischio-jambiers/quadriceps dans, rupture totale du ligament croisé antérieur

EQUILIBRIO ISQUIO TIBIALES/CUÁDRICEPS EN INDIVIDUOS CON RUPTURA TOTAL DEL LIGAMENTO CRUZADO ANTERIOR

RESUMEN

Este estudio tubo como objetivo evaluar la relación isquio tibiales/cuádriceps en las amplitudes de 30º e 15º de flexión durante la contracción dinámica concéntrica en individuos con ruptura total del ligamento cruzado anterior unilateral. Fueron analizados 16 individuos del género masculino con edad media de 33 años y tiempo medio de lesión de 5 meses. Para análisis isocinética fue utilizado dinamómetro isocinético REV9000. Los individuos fueron posicionados en el aparato de acuerdo con las orientaciones del fabricante. El teste isocinético fue realizado con cinco repeticiones con velocidad 60º/s, en el modo concéntrico. El parámetro estudiado fue la relación isquio tibiales/cuadriceps independiente del ángulo, en 15º y 30º de flexión. Fue realizado un calefacción previó con bicicleta ergometric, estiramiento del cuadriceps y isquio tibiales, y adaptación con cinco repeticiones submáximas en el dispositivo. Padronizó avaluá primeramente el miembro sin lesión y posteriormente el miembro con lesión. Utilizó el test Mann-Whitney, utilizando el nivel de la significación de el 5% (?=0,05). Los resultados indican una diferencia significativa al comparar la relación isquio tibiales/ cuádriceps independiente del ángulo y en la amplitud de 30º (p=0,001), y 15º de flexión de la articulación de la rodilla (p=0,047) del miembro lesionado con el miembro sin lesión. Se concluye que independiente de la forma a ser calculada la relación isquio tibiales/cuádriceps, ambas relatan el estado de desequilibrio muscular, siendo que la relación isquio tibiales/cuádriceps en los ángulos específicos presentan mayor desequilibrio muscular pudiendo, de esta forma, explicar la sensación de falseo de la articulación.

PALABRAS CLAVES: relación isquio tibiales/cuádriceps, ruptura total del ligamento cruzado anterior, isocinética

EQUILIBRIO ISQUITIBIAIS/QUADRÍCEPS EM SUJEITOS COM RUPTURA TOTAL DO LIGAMENTO CRUZADO ANTERIOR

RESUMO

Este estudo teve como objetivo de avaliar a relação isquitibiais/quadríceps nas amplitudes de 30º e 15º de flexão durante a contração dinâmica concêntrica em indivíduos com ruptura total do ligamento cruzado anterior (LCA) unilateral. Foram avaliados 16 sujeitos do gênero masculino com idade média de 33 anos e tempo médio de lesão 5 meses. Para avaliação isocinética foi utilizado dinamômetro isocinético REV9000. Os sujeitos foram posicionados no aparelho de acordo com as orientações do fabricante. O teste isocinético foi realizado com cinco repetições na velocidade 60º/s, no modo concêntrico. O parâmetro estudado foi à relação isquiotibiais/quadríceps independente do ângulo, em 15º e 30º de flexão. Foi realizado um aquecimento prévio com bicicleta ergométrica, alongamento do quadríceps e isquiotibiais, e adaptação com cinco repetições submáximas no aparelho. Padronizou avaliar primeiramente o membro sem lesão e posteriormente o com lesão. O tratamento dos dados foi feita através do teste Mann-Whitney, utilizando o nível de significância de 5% (=0,05). Os resultados indicam uma diferença significativa ao comparar a relação isquiotibiais/quadríceps independente do ângulo e na amplitude de 30º (p=0,001), e 15º de flexão da articulação do joelho (p=0,047) do membro lesionado com o membro sem lesão. Conclui-se que ao se adotar o valor de pico de torque da amplitude articular em 15º e 30º para calcular a relação flexor/extensor em indivíduos com ruptura do LCA, e melhor maneira para se verificar a estabilidade articular.

PALAVRA-CHAVE: Relação Isquiotibiais/Quadríceps, ruptura total do ligamento cruzado anterior, isocinético.