

THE ARTICULAR MUSCLE OF THE KNEE: MORPHOLOGY AND DISPOSITION

MÚSCULO ARTICULAR DE LA RODILLA: MORFOLOGÍA Y DISPOSICIÓN

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SUMMARY: To investigate the morphologic aspects and the relations of the articular muscle of the knee with articular cavity of the knee, as well as the disposal of muscular fibers to the level of femur, besides comparing the muscular mass of the articular of the knee with the rest of the muscular mass of the inferior member, 15 inferior members of adult human corpse of both sex, settled in formol and transversally parted, in middle third of the thigh and in proximal third of the leg, had been analyzed. The study method was of macroscopic dissection. The articular muscle of the knee was present in all the analyzed material and in 93.3% of the cases it had its proximal point of attachment in the distal anterior portion of femur. Amongst analyzed specimens, 40% had shown a sufficiently reduced muscular mass and a trapezoidal type. This muscle presented a distal insertion at an average distance of 3.07cm above of the superior edge of the trochlea and an anterior insertion in proximal edge of the suprapatellar bursa. The number of bundles of each muscle varied from 2 to 7 bundles which, in its majority, had presented a vertical direction. The muscle showed an anterior position on the distal third of the femur. Our results suggest that the same size and the relations of this with the suprapatellar bursa can be directly related with the rest of the muscular mass of the member of the individual, therefore when it works to increase muscular tonus of the quadriceps, it is also, in indirect way, increasing the articular muscle of the knee and improving its performance in the articular cavity.

KEY WORDS: 1. Knee; 2. Articular muscle of the knee; 3. Suprapatellar bursa; 4. Morphology.

INTRODUCTION

The articular muscle of the knee is a small muscle located in the anterior surface and the more inferior surface of the femoral diaphysis (Ahmad, 1975; Gray, 1988; Kendall & McCreary, 1995; Kincaid *et al.*, 1996; Moore & Dalley, 2001). It is found below the medial vastus muscle and there is a close relation between these two muscles (Didio *et al.*, 1967; Latarjet & Ruiz-Liard, 1993; Smith *et al.*, 1997).

According to the literature the articular muscle of the knee has the function of retraction of the suprapatellar bursa (Rouvière, 1971; Testut & Latarjet, 1977; Kimura & Takahashi, 1987; Salgado, 1995; Puig *et al.*, 1996), or the retraction of the synovial menbrane (Didio *et al.*, 1969; Kendall & McCreary; Smith *et al.*), and more frequently the retraction of the articular capsule (Ahmad; Gray; Kendall & McCreary; Puig *et al.*; Smith *et al.*; Moore & Dalley; Didio, 2002), avoiding the compression of these structures during the extension of the knee (Ahmad; Testut & Latarjet; Puig *et al.*; Smith *et al.*; Didio, 2002). Some authors associate its contraction with the contraction of quadriceps femoral muscle (Didio *et al.*, 1969; Rouvière; Testut & Latarjet) and

that the length of the anterior muscle of the knee is altered in the extension and also in the flexion (Puig *et al.*), in order to keep itself in a suitable position during these movements (Rouvière; Testut & Latarjet; Kimura; Kendall & McCreary; Smith *et al.*).

However the dates in the literature are scarce and imprecise concerning about the morphologic aspects and situation of the muscle as well as its relations with the suprapatellar bursa and trochlea of the femur. Therefore, the aim of our work was to evaluate the morphologic aspects (frequency, form, length, number of muscular bundles) and the relations of articular muscle of the knee with the articular cavity of the knee (distance between the distal insertion of the muscle and the superior edge of the trochlea), as well as the disposal of muscle fibers to the level of femur (proximal and distal fixation and direction and position of muscular bundles) besides comparing the muscular mass of the articular muscle of the knee with the rest of the muscular mass of the inferior member, in order to clarify the anatomic behavior of this muscle.

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MATERIAL AND METHOD

15 inferior members of human corpse of both sex, from the Departamento de Anatomia da Universidade Federal de Pernambuco had been analyzed. Each anatomic piece was settled in formol 10% and transversally parted, in middle third of the thigh and in proximal third of the leg, with all soft structures preserved.

The study method was the macroscopic dissection. Longitudinal lateral and medial incisions had been made in the quadriceps femoral muscle to the level of the apex of the patella. Afterwards, the quadriceps muscle was carefully laid by the fibrofascial slot, in order to separate the articular muscle of the knee from the vastus intermedialis muscle, preserving, the proximal and distal insertions of articular muscle, since in the most of times, the slot was very diminished.

After this procedure, each specimen was analyzed by the frequency, that is, the presence of the articular muscle of the knee in the anatomic analyzed pieces and by the form or geometric aspect showed on the femoral surface, based, partially in the classification proposed by Didio *et al.* (1967) wich classified the muscle in three forms: rectangular, trapezoid and inverted trapezoid. Besides that, it was observed with the use of an analogic pachymeter Vernier Calpers with accuracy of 0,02mm, the average length of the muscle, by the arithmetic average obtained by the length of the found muscular bundles, and the distance from the more distal fiber to the trochlea. The insertion of the bundles in the suprapatellar bursa, the number of muscular bundles and direction and position of muscular bundles of articular muscle in the distal portion of femur was also analyzed.

RESULTS

The articular muscle of the knee was present in all the analyzed material (100% of analyzed members), situated below the intermedial vastus muscle, separate from this by a adipose slot which amount of tissue varied from case to case. The removal of the excess of these adjacent tissues allowed the visibility of the articular muscle of the knee which in 93.3% of cases had its proximal fixation point in the distal anterior portion of femur and in 40% of analyzed cases, showed a muscular mass much reduced (slender muscle) (Fig. 1).

Concerning about the form of the muscle, the most found was trapezoid (40%), in which the superior portion of the muscle was narrower than medium and inferior portions. The rectangular form showed similar widths of superior, medium and inferior portions of the articular muscle and also showed a significant proportion (33.3%). It was observed, in less cases, two forms different from that: triangular and irregular.

The total length of the articular muscle of the knee showed an average value of 6.17cm, varying from 3.81 to 8.45cm.

The distal insertion of muscular bundles was situated at an average distance of 3.07cm, varying from 2.01 to 4.15cm, above the superior edge of trochlea (Fig. 1) and the insertion of these bundles in the proximal edge of the suprapatellar bursa occurred, more anteriorly (57.1%).

The number of muscular bundles of each articular muscle of the knee varied from two to seven bundles (Fig. 2). However, the most of analyzed inferior members (33.3%) showed an articular muscle constituted by four muscular bundles.

Concerning about the direction of the bundles, more than half of the examined cases (60%) showed a mixed standard (vertical and oblique bundles) with the predominance of vertical bundles (73.33%).

The most of examined muscles (42.9%) showed an anterior disposal in distal third of femur.

DISCUSSION

The great difficulty to recognize the articular muscle of the knee as functional is due to the muscle is located deeply in the intermedial vastus muscle and very adhered to this muscle (Kendall & McCreary). Our study established the presence of the articular muscle of the knee as a muscular structure different from femoral quadriceps muscle, in all examined material what confirms the anatomic finds of Didio *et al.* (1967) and Kimura & Takahashi. These muscle had its origin in the anterior surface of the distal third of femur, as it was demonstrated by some authors (Ahmad; Gray; Kendall; Kincaid *et al.*; Moore & Dalley) and its muscular bundles was inserted in the articular capsule over the surface of the suprapatellar bursa (Rouvière; Ahmad; Kendall; Salgado; Moore & Dalley; Didio, 2002).

In our sample the articular muscle of the knee showed a reduced muscular mass (40% of the cases) suggesting that this musculature follows proportionally the trophic development of the musculature of the inferior member. However, the literature does not show dates about the trophic development of the articular muscle concerning the rest of the muscular mass of the inferior member.

Among the geometric forms of the muscle, according to the classification described by Didio *et al.* (1967), in our study the trapezoid form was the most observed followed by the rectangular form. However, the same authors described a higher proportion of rectangular form concerning the trapezoid. Only one of the inferior members analyzed, showed a triangular form



Fig. 1. Articular muscle of the knee with trapezoid geometric form and medium length of 5.32 cm, constituted by six muscular bundles of vertical direction.

similar to the one described by Didio *et al.* (1969), in which the muscle had its origin from only one bundle of muscular fiber and not from a set of bundles like the other forms. Among the observed specimen three did not show a defined geometric form, thus they were classified as irregular form.

Didio *et al.* (1967) in study realized in human corpse refer that the total medium length of the articular muscle of the knee was 8cm, similar to the finds of Salgado, in a description more generalized about the characteristics of this muscle, in which the length of the muscle was 8.1cm. Ahmad (1975), described in his studies a total medium length, higher, 9cm. In our study we found a musculature with a medium length of 6.17cm, what is less than the others from previous studies.

Concerning about the relations of the articular muscle with the articular cavity of the knee we observed that the muscular bundles were inserted at a medium distance of 3.07cm above the superior edge of the trochlea. However, it was not possible comparing our finds since are scarce the studies that relates the distances between the articular muscle and the osseous structures which compose the articular cavity.

Concerning about the insertion of bundles in the proximal edge of suprapatellar bursa, according to Didio *et al.* (1967) and Salgado this insertion was observed in the center of the proximal edge of the bursa. In this study, the insertion in the suprapatellar



Fig. 2. Articular muscle of the knee constituted by six muscular bundles inserted anteriomedio laterally in proximal edge of suprapatellar bursa (dotted arrow indicates the medial insertion and continuous arrow indicates the lateral insertion of muscular bundles in the bursa).

bursa was, predominantly in the anterior surface of the bursa. However, the quantity of samples that could be analyzed, in this aspect was less than the ones analyzed by previous studies.

According to Ahmad the articular muscle of the knee is constituted by one or two muscular bundles, and occasionally, the number of bundles can be three or four. According to Kimura & Takahashi and Puig, this muscle was constituted by one to seven bundles, and according to the first two authors, the ones composed by two, three and four bundles were more frequent. In fact, in this study, it was established that the number of muscular bundles of each muscle varied from two to seven and the most of muscles showed four muscular bundles (33.3%).

In this study, the bundles showed a mixed standard (vertical and oblique bundles) with predominance of vertical. Corroborating our results, Ahmad and Didio *et al.* (1967) observed that the most frequent direction of the fibers of this muscle was also vertical.

According to the description of Didio *et al.* (1967 and 1969) the articular muscle showed, with a higher frequency, an anterior disposal in the distal third of femur, what confirms our results, in which 42.6% of analyzed samples showed an anterior aspect in the distal third of femur.

Its a fact that the articular muscle, although is a little muscle, performs an important function, controlling the movements of suprapatellar bursa during the extension of the knee (Kimura & Takahashi; Smith *et al.*). The results of this study demonstrate that the size and even the relations of this muscle with the suprapatellar bursa can be directly related to the rest of muscular mass of the member of the individual, for according Didio *et al.* in individuals with an atrophy of this muscular mass, which frequency can improve with the age and the lack of physical exercises, can occur pain in the

region of the knee, due to the compression of synovial when walking.

Our finds suggest that the trophic development of the muscle follows, proportionally, the development of the rest of the muscular mass of the inferior member. Thus, is supposed that when the muscular tonus of the quadriceps is increased and consequently hypertrophied, the articular muscle, in indirect way, is also hypertrophied and has a powerful performance in the articular cavity.

TOSCANO, A E.; MORAES, A. S. R. & ALMEIDA, S. K. S. Músculo articular de la rodilla. Morfología y disposición. *Int. J. Morphol.*, 22(4):303-306, 2004.

RESUMEN: Con el objetivo de investigar los aspectos morfológicos y las relaciones del músculo articular de la rodilla, así como la disposición de las fibras musculares a nivel del fémur, además de comparar la masa muscular del referido músculo con el resto de la masa muscular del miembro inferior, fueron analizados 15 miembros inferiores de cadáveres humanos adultos, de ambos sexos, fijados en formol y seccionados transversalmente, a nivel del tercio medio del muslo y tercio proximal de la pierna. El músculo articular de la rodilla estaba presente en todo el material analizado y en el 93,3% de los casos tenía su punto de origen en la parte anterior distal del fémur. Entre las piezas analizadas, un 40% mostró una masa muscular bastante reducida y en forma trapezoidal. Ese músculo presentó en la inserción una distancia promedio de 3,07 cm arriba del borde superior de la tróclea, variando los haces musculares entre 2 y 7. Éstos, en su mayoría, presentaron una dirección vertical. El músculo mostró una disposición anterior en el tercio distal del fémur. Nuestro resultado sugiere que el tamaño y las relaciones del músculo articular de la rodilla con la bolsa sinovial suprapatellar, pueden estar directamente relacionados con el resto de masa muscular del miembro inferior. Por tal motivo, cuando se trabaja para aumentar el tono muscular del músculo recto femoral, se está provocando, de manera indirecta, la hipertrofia del músculo articular de la rodilla y potenciando su desempeño en la cavidad articular.

PALABRAS CLAVE: 1. Rodilla; 2. Músculo articular de la rodilla; 3. Bolsa suprapatellar; 4. Morfología.

REFERENCES

- Ahmad, I. Articular muscle of the knee – articularis genus. *Bull. Hospital Joint Disease*, 36(1):58-60, 1975.
- Didio, L. J. A.; Zappalá, A. & Carney, W.P. Anatomic functional aspects of the musculus articularis genus in man. *Acta Anatomica*, 67 (1):1-160, 1967.
- Didio, L. J. A.; Zappalá, A.; Cardoso, A. D. & Diaz, R. A. Musculus articularis genus in human fetuses, newborn and young individuals. *Ant. Anz. Bd.*, 124:121-32, 1969.
- Didio, L. J. A. *Tratado de anatomia sistêmica aplicada*. 2. ed. São Paulo, Atheneu, 2002.
- Gray, H. *Gray anatomia*. 29. ed. Rio de Janeiro, Guanabara Koogan, 1988.
- Kendall, F. P. & McCreary, E. K. *Músculos: provas e funções*. São Paulo, Manole, 1995.
- Kimura, K. & Takahashi, Y. M. Articular genus: observations on arrangement and consideration of function. *Surg. Radiol. Anat.*, 3(9):231-9, 1987.
- Kincaid, S. A.; Rumph, P. F.; Garrett, P. D.; Baird, D. K.; Kammermann, J. R. & Visco, D. M. Morphology of the musculus articularis genus in dog with description of ectopic muscle spindles. *Anat. Histol. Embryol.*, 25(2):113-6, 1996.
- Latarjet, M. & Ruiz-Liard, A. *Anatomia humana*. 2 ed. São Paulo, Panamericana, 1993.
- Moore, K. L. & Dalley, A. F. *Anatomia orientada para a clínica*. 4. ed. Rio de Janeiro, Guanabara Koogan, 2001.
- Puig, S.; Dupuy, D. E.; Sarmiento, A.; Boland, G. W.; Grigoris, P. & Green, E. R. Articular muscle of the knee: A muscle seldom recognized on MR imaging. *Am. J. Roentology*, 166:1057-60, 1996.
- Rouvière, H. *Anatomía descriptiva y topográfica*. Barcelona, Salvat, 1971.
- Salgado, A. S. I. *Reeducação funcional proprioceptiva do joelho e tornozelo*. São Paulo, Lovise, 1995.
- Smith, L. K.; Weiss, F. L. & Lehnkuhl, L. D. *Cinesiologia clínica de Brunnstrom*. 5. ed. São Paulo, Manole, 1997.
- Testut, L. & Latarjet, A. *Tratado de anatomía humana*. Barcelona, Salvat, 1977.

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