Do ligament-bone attachment angles have any effect on patellar chondromalacia?

Ligament-kemik yapışma açılarının patellar kondromalazi gelişimi üzerine etkisi var mı?

Ligament-bone attachment angles

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Öz

Amaç: Bizim bu çalışmadaki amacımız patella çevresindeki bağların patella ve tibiaya yapışma açıları ile patellar kondromalazi arasındaki ilişkiyi araştırmaktır. Gereç ve Yöntem: Rastgele olarak seçilen 30'u patellar kondromalazili ve 30'u kondromalazi bulunmayan toplam 60 diz MR görüntülemesi çalışmaya dahil edildi. Patellar kondromalazi bulunup bulunmadığının tesbitinde yağ baskılı T2 ağırlıklı fast spin-echo görüntüleri kullanıldı. Qudriseps tendonu ile patella (Q-P), patella ile patellar tendon (P-PT) ve patellar tendon ile tibia (PT-T) arasındaki yapışma açıları ölçüldü. Bulgular: Hastaların ortalama yaşı kondromalazili grupta 45,1 ± 14,9; kondromalazisiz grupta ise 37,2 ± 11,9 olarak hesaplandı. Ortalama Q-P açısı kondromalazili grupta 42,4 ± 9,2 derece; kondromalazisiz grupta ise 46,1 ± 6,9 derece olarak hesaplandı (p=0.083). Ortalama P-PT açısı kondromalazili grupta 113,9 ± 11,1 derece; kondromalazisiz grupta ise 112,9 ± 11,7 derece olarak hesaplandı (p=0.727). Ortalama PT-T açısı kondromalazili grupta 29,9 ± 5,9 derece; kondromalazisiz grupta ise 28,9 ± 7,6 derece olarak hesaplandı (p=0.608). Tartışma: Bu çalışma patella çevresindeki bağların patella ve tibiaya yapışma açıları ile patellar kondromalazi gelişimi arasında ilişki olmadığı ortaya koymuştur.

Anahtar Kelimeler

Kondromalazi; Manyetik Rezonans Görüntüleme; Diz; Patella

Abstract

Aim: The aim of this study was to evaluate the relationship between the ligament to bone attachments and patellar chondromalacia. Material and Method: This study included a total of 60 knee magnetic resonance imagings of 60 patients (30 with patellar chondromalacia, and 30 without patellar chondromalacia) which were selected randomly from our hospital's picture archiving and communication system records. T2 weighted fast spin-echo images with fat-saturation were used to detect the presence or absence of chondromalacia patella. The angles between quadriceps tendon and patella (Q-P), patella and patellar tendon (P-PT), and patellar tendon and tibia (PT-T) were measured separately. Results: The mean ages of the patients were 45.1 ± 14.9 for the patellar chondromalacia group and 37.2 ± 11.9 for the non-chondromalacia group. The mean value of the Q-P angle was 42.4 ± 9.2 degrees in the chondromacia group and 46.1 ± 6.9 degrees in the non-chondromalacia group (p=0.083). The mean value of the P-PT angle was 113.9 ± 11.1 degrees in the chondromacia group and 112.9 ± 11.7 degrees in the non-chondromalacia group (p=0.727). Finally, the mean value of the PT-T angle was 29.9 ± 5.9 degrees in the chondromacia group and 28.9 ± 7.6 degrees in the non-chondromalacia group (p=0.608). Discussion: This is the first study that focused on the ligament-bone attachments around the patella. This study revealed that there is no relationship between the attachment angles of the ligamentous structures around the patella and the presence of chondromalacia.

Keywords

Chondromalacia; Magnetic Resonance Imaging; Knee; Patella

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Introduction

Chondromalacia of the patella has a wide course starting from the softening of articular cartilage to total destruction of the cartilage. It is the most frequently diagnosed cartilage lesion in the knee joint. Although chondromalacia of the patella is a common phenomenon, its etiology is unclear. Many factors such as mechanical factors, body mass index, infrapatellar fat pad volume, and proteoglycan depletion have been implicated [1-3]. The mechanism is considered to be the breakdown of articular cartilage and damage to superficial chondrocytes resulting in release of proteolytic lysosomal enzymes [4].

The attachment of quadriceps to patella, of patellar tendon to patella, and of patellar tendon to tibia differ from person to person. The aim of this study was to evaluate the relationship between the ligament to bone attachments and patellar chondromalacia.

Material and Method

This retrospective study was approved by the Institutional Review Board. This study included a total of 60 knee magnetic resonance imagings (MRI) of 60 patients (30 with patellar chondromalacia and 30 without patellar chondromalacia) which were selected randomly from our hospital's picture archiving and communication system (PACS) records. All MRIs were obtained with a 1.5-T MR (Gyroscan Intera, Philips, Best, The Netherlands) system equipped with a QD knee coil. Patients with patella alta, patella baja, patellar tilt, patellar subluxation, previous knee surgery, and effusion were excluded. T2 weighted fast spin-echo images with fat-saturation were used to detect the presence or absence of chondromalacia patella. The presence of surface irregularity and subtle signal changes, areas of hyperintensity, subchondral reactive bone marrow oedema pattern, and secondary changes of osteoarthritis at the patella in MRI were accepted as patellar chondromalacia. The angles between quadriceps tendon and patella (Q-P), patella and patellar tendon (P-PT), and patellar tendon and tibia (PT-T) were measured separately. All the measurements were done digitally by one experienced orthopaedic surgeon at two different times, and the mean values were calculated.

Statistical Analyses

The IBM SPSS statistical software package (SPSS, version 23 for Windows; SPSS Inc., Chicago, IL, USA) was used to perform all statistical analyses. The distribution of the data was evaluated with the Kolmogorov Smirnov test. The independent samples t-test was used for the statistical comparison of the normally-distributed parameters. Correlation between measurements was analyzed with interclass correlation analysis. All data were expressed as mean value ± standard deviation. A value of $p < 0.05$ was considered significant in all statistical analyses.

Results

Of the randomly chosen 30 patients with patellar chondromalacia, 16 were males and 14 were females. Among the 30 patients without patellar chondromalacia, 11 were males and 19 were females. The mean age of the patients was 45.1 ± 14.9 for the patellar chondromalacia group and 37.2 ± 11.9 for the non-chondromalacia group. There was no statistically significant difference between the groups in terms of age (p=0.096). The mean value of the Q-P angle was 42.4 ± 9.2 degrees in the chondromacia group and 46.1 ± 6.9 degrees in the non-chondromalacia group. There was no significant difference between the groups (p=0.083). The mean value of the P-PT angle was 113.9 ± 11.1 degrees in the chondromacia group and 112.9 ± 11.7 degrees in the non-chondromalacia group. There was no significant difference between the groups (p=0.727). Finally, the mean value of the PT-T angle was 29.9 ± 5.9 degrees in the chondromacia group and 28.9 ± 7.6 degrees in the non-chondromalacia group. There was no significant difference between the groups (p=0.608) (Figure 1). Intra-observer agreements were 0.78 (95% confidence interval [CI], 0.63–0.87) for Q-P, 0.73 (95% CI, 0.54–0.84) for P-PT, and 0.79 (95% CI, 0.65–0.88) for PT-T. There were perfect correlations between two measurements for Q-P and PT-T, and there was a good correlation for P-PT.

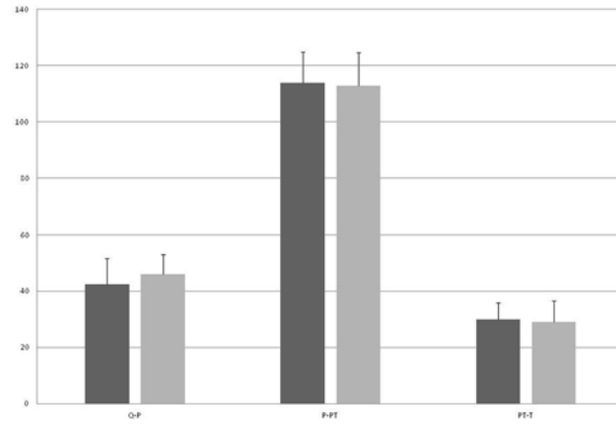


Figure 1. The mean values and standart deviations for Q-P, P-PT, and PT-T angles. (The bold columns show the chondromalacia groups.)

Discussion

Chondromalacia patella tend to progress starting from fibrillation with loss of healthy cartilage, osteoarthritis, and ensuing pain and disability. Some medical and surgical treatment options such as pain management and use of chondroprotective pharmacological agents, joint lavage, and mechanical debridement have been performed. However, none has been proven to be effective [5]. Therefore, the most effective treatment against chondromalacia patella is trying to prevent it before it starts. That increases the importance of the studies on understanding the etiology and the mechanisms that cause patellar chondromalacia. This study focused on one of the mechanical factors that may cause chondromalacia.

Although arthroscopy is considered to be the gold standard for the diagnosis of chondromalacia, MRI is an important method for evaluating chondral lesions in the patella because it is non-invasive [6]. Proton-density weighted images and the T2 weighted fast spin-echo images with or without fat-saturation, the gradient-echo sequence such as the fat-suppressed spoiled gradient-echo images, and the fat-suppressed fast low angle shot images are frequently used sequences for evaluating the knee [7]. Hyaline cartilage shows low signal intensity in T1-weighted images (WI). However, T1-WIs do not provide good contrast between joint effusion and the cartilage surface, a

shortcoming that limits their usefulness in the assessment of focal cartilaginous defects. Hyaline cartilage shows high signal intensity in T2-WIs. T2-WIs evaluate the subchondral bone and the interface between the cartilage and the synovial fluid, with less distinction between changes in the intrinsic signal of the hyaline cartilage. The articular cartilage appears hyperintense on T2 weighted fast spin-echo sequences. It provides excellent morphological detail of articular cartilage. Also, the other structures of knee joint can be identified. Therefore, in this study we used T2 weighted fast spin-echo images with fat-saturation to detect the precence or absence of chondromalacia patella.

Aksahin et al. researched the sagittal plane tilting deformity of the patellofemoral joint and showed the mean P-PT angle was significantly lower in the chondromalacia group than in the control group [8]. We found no difference in P-PT angle between groups with and without patellar chondromalacia.

Kusnezov et al. reported that increasing chronological age, female sex, black race, and physical activity significantly correlated with an increased risk for chondromalacia patellae in an active population [9]. Also, it was revealed that patellofemoral joint morphology has a relationship to chondromalacia patella [10]. Edama et al. found that posterior attachment of the patellar tendon to the patella related to shorter patellar tendon, suggesting the possibility of strong tensile stress on the tendon fibers of the posterior facet of the inferior patellar pole [11]. A high ratio of trochlear sulcus angle to trochlear depth was identified as an independent risk factor for chondromalacia patella [12]. Our study focused on ligamentous parameters without evaluating any bony development, but we found no relationship between the ligamentous structures around the patella and chondromalacia.

The relationship between the attachment of quadriceps tendon to patellar superior pole and the development of patellar chondromalacia has not been investigated yet. However, the importance of quadriceps muscle exercises for pain relief in patients with chondromalacia patella is well known [13]. On the other hand, although physical activity improved the quadriceps muscle, Zhang reported that it also increased the prevalence of chondromalacia patella [14]. This study investigated and revealed that the attachment angle of quadriceps tendon to the superior pole of the patella had no significant relationship to the presence of chondromalacia patella.

This is the first study to focus on the ligament-bone attachments around the patella, and it revealed some novel information. However, the small number of patients and the lack of information about their complaints and their clinical symptoms were the limitations for this study. Prospective randomized trials with larger case series will help us better understand the etiology of the development of chondromalacia patella.

Competing interests

The authors declare that they have no competing interests.

References

1. Insall J, Falvo K A, Wise D W. Chondromalacia patellae. J Bone Joint Surg Am 1976; 1: 1-8.
2. Väätäinen U, Häkkinen T, Kiviranta I, Jaroma H, Inkinen R, Tammi M. Proteoglycan depletion and size reduction in lesions of early grade chondromalacia of the patella. Ann Rheum Dis 1995;54(10):831-5.
3. Duran S, Aksahin E, Kocadal O, Aktekin CN, Hapa O, Gencturk ZB. Effects of body mass index, infrapatellar fat pad volume and age on patellar cartilage defect. Acta Orthop Belg 2015;81(1):41-6.
4. Bentley G, Dowd G. Current concepts of etiology and treatment of chondromalacia patellae. Clin Orthop 1983;189:209–28.
5. Uthamanthil RK, Edwards RB, Lu Y, Manley PA, Athanasiou KA, Markel MD. In vivo study on the short-term effect of radiofrequency energy on chondromalacic patellar cartilage and its correlation with calcified cartilage pathology in an equine model.J Orthop Res 2006;24(4):716-24.
6. Kim HJ, Lee SH, Kang CH, Ryu JA, Shin MJ, Cho KJ, et al. Evaluation of the chondromalacia patella using a microscopy coil: comparison of the two-dimensional fast spin echo techniques and the three-dimensional fast field echo techniques. Korean J Radiol. 2011;12(1):78-88.
7. Disler DG, McCauley TR, Wirth CR, Fuchs MD. Detection of knee hyaline cartilage defects using fat-suppressed three-dimensional spoiled gradient-echo MR imaging: comparison with standard MR imaging and correlation with arthroscopy. AJR 1995;165:377–82.
8. Aksahin E, Aktekin CN, Kocadal O, Duran S, Gunay C, Kaya D, et al. Sagittal plane tilting deformity of the patellofemoral joint: a new concept in patients with chondromalacia patella. Knee Surg Sports Traumatol Arthrosc. 2016; DOI: 10.1007/s00167-016-4083-4
9. Kusnezov N, Watts N, Belmont PJ Jr, Orr JD, Waterman B. Incidence and Risk Factors for Chronic Anterior Knee Pain. J Knee Surg 2016;29(3):248-53.
10. Tuna BK, Semiz-Oysu A, Pekar B, Bukte Y, Hayirlioglu A. The association of patellofemoral joint morphology with chondromalacia patella: a quantitative MRI analysis. Clin Imaging 2014;38(4):495-8.
11. Edama M, Kageyama I, Nakamura M, Kikumoto T, Nakamura E, Ito W, et al. Anatomical study of the inferior patellar pole and patellar tendon. Scand J Med Sci Sports 2017; doi: 10.1111/sms.12858.
12. Resorlu H, Zateri C, Nusran G, Goksel F, Aylanc N. The relation between chondromalacia patella and meniscal tear and the sulcus angle/ trochlear depth ratio as a powerful predictor. J Back Musculoskelet Rehabil 2016; DOI: 10.3233/BMR-160536
13. Lack S, Barton C, Vicenzino B, Morrissey D. Outcome predictors for conservative patellofemoral pain management: a systematic review and meta-analysis. Sports Med 2014;44(12):1703-16.
14. Zhang H, Kong XQ, Cheng C, Liang MH. A correlative study between prevalence of chondromalacia patellae and sports injury in 4068 students. Chin J Traumatol 2003;6(6):370-4.

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