Original Article

İzole Menisküs Yırtıklarında Alt Ekstremite Q Açısının ve Rotasyonel Dizilimlerin Karşılaştırılması

A comparison of rotational alignment and Q angle of the lower limb in isolated meniscal tears

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Abstract

Objectives: The aim of this study was to evaluate the isolated meniscal tears and its relation with the rotational alignments and quadriceps angles (*Q angles*) of the lower limb.

Patients and methods: This study included 60 knees of 30 patients with unilateral isolated meniscal tears (mean age 35.3; range 17 to 47 years) and 60 knees of 30 healthy men were examined (mean age, 33.6; range 24 to 46 years) as controls. We divided into four groups of 30 limbs each as follows. Group 1 included the patients with isolated meniscal tears, and Group 2 included the patients with the contralateral intact limb. However, Group 3 included the healthy controls with ipsilateral limb, and Group 4 included the healthy controls with contralateral limb. The lower extremity of all groups were imaged by computed tomography and femoral anteversion, tibial torsion, and *Q angles* were measured.

Results: There was no statistical difference in the rotational alignments with the lower limb between the four groups. Additionally, there was no statistical difference in the *Q angles* between the isolated meniscal tears group and the contralateral knees. In this study, we observed significantly higher *Q angle* in the patient groups than controls.

Conclusion: We were not able to show any association between the isolated meniscal tears and rotational alignments with the lower limb. This result suggest that the lower extremity torsional deformities cannot be regarded as primary etiological factor for the isolated meniscal tears. However, increased *Q angles* may be played a role as predisposing factors for meniscal tears.

Key Words: Bone Anteversion; Tibial torsion; Menisci

Öz

Amaç: Bu çalışmanın amacı alt ekstremitenin rotasyonel diziliminin ve kuadriseps (Q) açısının izole menisküs yırtıklarıyla ilişkisini değerlendirmektir.

Hastalar ve yöntem: Bu çalışma tek taraflı izole menisküs yırtıklı 30 hastanın 60 dizi (hepsi erkek; ortalama yaşı 35.3; dağılım:17-47 yaş) ile kontrol grubu olarak, 30 sağlıklı gönüllünün 60 dizini (hepsi erkek; ortalama yaşı 33.6; dağılım:24-46 yaş) içeriyordu. Hastaların tanıları manyetik rezonans görüntüleme (MRG) ve ardından yapılan artroskopik cerrahi ile konuldu. 30 dizden oluşan dört grup oluşturuldu. Grup 1 izole menisküs yırtıklı hastalar ve Grup 2 hastaların sağlam dizlerini kapsamaktayken; Grup 3 sağlıklı gönüllülerin hasta dizine karşılık gelen tarafı, Grup 4 ise sağlam taraf dizlerinden oluşturuldu. Tüm grupların alt ekstremiteleri bilgisayarlı tomoğrafi (BT) eşliğinde femoral anteversiyon ve tibial torsiyon dereceleri ile Q açıları ölçüldü.

Bulgular: Dört grubun alt ekstremiteleri arasında rotasyonel dizilim farkı saptanmadı. Ayrıca, hastaların menisküs yırtık taraflı ve sağlam dizi arasında Q açısı yönünden bir fark görülmedi. Bu çalışmada hasta grubundaki Q açısını kontrol grubundan önemli derecede daha yüksek gözlemledik.

Sonuç: Çalışmamızda izole menisküs yırtığı ile alt ekstremitenin rotasyonel dizilimi bakımından herhangi bir ilişki gösteremedik. Bu bulgu izole menisküs yırtığında, alt ekstremitenin rotasyonel deformitelerinin başlıca etken olamayacağını düşündürmektedir. Ancak, artmış Q açısı menisküs yırtıklarına eğilimi artırıcı bir etken olabilir.

Anahtar kelimeler: kemik anteversiyonu; tibial torsiyon, meniskusler

Introduction

The meniscus is a crescent- shaped disc of cartilage tissue in the knee. Their main function is to act as shock absorbers for the knee as well as allowing for the proper interaction and weight distribution between the tibia and the femur (1–3). The most common cause of meniscal tears is trauma (4). The traumatic meniscus tears occur with some type of twisting motion while the knee is slightly bent and in a weight-bearing position. However, sometimes as the cause of meniscal tears, a history of trauma may not be available (5).

The alignment of the knee joint plays an important role for load distribution. If the load-bearing surface areas are changed, abnormal distribution of stresses on the tibiofemoral joint may occur. Computed tomography (CT) currently is considered to be the most accurate diagnostic tool for measuring femoral anteversion and tibial torsion (6,7). Furthermore, it has been stated that the quadriceps angle (*Q angle*) has been associated with patellofemoral pain syndrome and knee injuries (8,9).

There are many studies about the relationship between the rotational alignments and the patellofemoral disorders (10–13). In addition, in several study, the axial or rotational malalignment of the lower limb is shown as an important etiological factor in the patient with knee osteoarthritis (14–16). In a recent article, axial alignment of the lower limb was evaluated in patients with isolated meniscal tears and found to be closely related to the presence of medial meniscal tears (5). However, to the best of our knowledge, no reports on the correlation between rotational alignment of the lower extremity and isolated meniscal tears.

It was hypothesized that if torsional deformities have an effect on the development of meniscal tears, femoral and tibial torsional values would be different between patients with meniscal tears and those without. Therefore, we investigated the rotational alignment in femur and tibia in the patient with isolated meniscal tears and evaluated their relationship with the *Q angle*.

Patients and methods

Patients

This cross-sectional study included 60 knees in 30 patients with unilateral isolated meniscal tears (all males; mean age 35.3; range 17 to 47 years) diagnosed according to the magnetic resonance imaging (MRI) and then during arthroscopic surgery. As a control, we examined 60 knees of 30 healthy men volunteers with no complaints in the knee who had been referred to our clinic for other reasons (average age, 33,6; range 24 to 46 years). They showed no ligamentous injuries, and no abnormal radiographic findings by clinically. We divided into four groups of 30 limbs each as follows. Group 1 included the patients with isolated meniscal tears, and Group 2 included the patients with the contralateral intact limb. However, Group 3 included the healthy controls with ipsilateral limb, and Group 4 included the healthy controls with contralateral limb. All patients were informed and gave consent for evaluation.

Computed tomography measurement of lower limb version

For measurement of rotational alignment in femur, and tibia in 120 limbs, was scanned by helical CT (Toshiba X-vision,) using the following parameters: Kv 120, mAs 200, table feed 5 mm/sec, slice thickness and intervals 5 mm, matrix 512x512. During the CT examination, the subjects were in the supine position with the hips and knees extended. To obtain horizontal and parallel extremities and prevent motion, the pelvis and lower limbs were stabilized with adhesive tape onto an adjustable Plexiglas support.

A frontal scan of the lower leg was made to select the correct level of transverse scans. In the proximal femur, the first transverse section imaged the trochanter major, femoral neck, femoral head of both sides, and we selected a section that showed femur neck and greater trochanter. Thus, the first reference line was drawn through the middle of femoral neck (Fig. 1). In the distal femur, the second transverse section was made through the medial and lateral condyles of the femur, below the lower pole of the patella, and we selected the section that showed the largest medial and lateral femoral condyles of both sides. Thus, the second reference line was drawn through posterior border of condyles of the distal femur (Fig. 2). The femoral torsion angle was measured as the angle between the proximal and distal femoral reference lines. In the proximal tibia, we selected the section immediately below the joint line to draw a posterior tangential reference line of proximal tibial condyles measuring the widest diameter between the two tibial condyles of both sides. Thus, the third reference line was drawn through posterior border of proximal tibial condyles (Fig. 3). In the distal tibia, we selected the section immediately above the joint line that showed medial and lateral malleoli of both sides. Thus, the fourth reference line was drawn through the middle of medial and lateral malleoli (Fig. 4). The tibial torsion angle was measured as the angle between the proximal and distal tibial reference lines.

Q angle was measured in a standing position which standardized stance using a goniometer and represented the angle formed by a line from the anterior superior iliac spine to the patella center and a line from the patella center to the tibial tuberosity (17).

S*tatistical analysis*

The results are presented in form of knees rather than patients. Mean values and standard deviations of the measured angles were calculated for each group. The values for in all groups were expressed as mean ±SD (%), and for statistical analysis, t-test was used in comparisons between two groups, and analysis of ANOVA method was used when three groups or more were compared. Significance was accepted at the $p < 0.05$ level.

Results

One hundred twenty limbs were included in this study. In the patients group, the mean angle of femoral torsion in knees with isolated meniscal tears was 10.9±6.8° and in the contralateral knee was 10.7±7.2°. In the control group, ipsilateral knee femoral torsion angle was 11.6±7.3°, and in the contralateral knee was 10.5±7.2°. However, there were no significant differences for femoral torsion (p>0.05) between the involved and the contralateral knees in patients and control groups.

The mean angle of tibial torsion was 22.7±6.7° in patients with isolated meniscal tears, and was 24.6±6.5° in the contralateral knee. In the control group, in the ipsilateral knee tibial torsion angle was 24.8±8.2°, and was 25.4±7.2° in the contralateral knee. However, there were no significant differences between the involved and the contralateral knees in patients and control groups any comparisons of tibial torsion angle (*P* > 0.05).

The mean *Q angle* was 16.0±5.9° in patients with isolated meniscal tears, and was 14.8±5.7° in the contralateral knee. In the control group, the ipsilateral knee *Q angle* was 9.8±2.3°, and was 9.6±2.3° in the contralateral knee. There were no significant differences between the involved and the contralateral knees in patients and control groups any comparisons of *Q angle* (P > 0.05). There were no significant differences between the involved and the contralateral knees in patients any comparisons of *Q angle* (P > 0.05). Additionally, there were no significant differences between the ipsilateral and the contralateral knees in control groups any comparisons of *Q angle* (P > 0.05). However, the Q angles were greater in the patient groups than control groups, and this difference was found to be statistically significant (p<0.01) (Table 1).

Discussion

Our study showed that there was no association between the isolated meniscal tears and the rotational alignments with the *Q angle* in the lower limb. This is the first report about the isolated meniscal tears and its correlation with the rotational alignments with the *Q angle* in the lower limb.

In a previous study, the association between tibial torsion and knee joint pathology has been reported (18). There are several studies about the relationship between the rotational alignments and the patellofemoral area. Lower extremity alignment has been noted that biomechanical changes due to abnormal alignment may influence joint loads. Lee *et al*. (11) demonstrated that if the femoral rotation results increase, patellofemoral contact pressure could rise on the contra lateral facets of the patella, however, if the tibial rotation results increase, patellofemoral contact pressure could rise on the ipsilateral facets of the patella. Thus, the increased femoral anteversion and the increased external tibial torsion are emphasized as probable causes of anterior knee pain (10–13). However, in recent studies, no relationship was found between the rotational malalignment of lower extremity and patellofemoral disorders (19). Furthermore, this increased knee version has been blamed as a risk factor for acute and chronic lower extremity injuries (17). Thus, increased hip internal rotation and increased tibial external rotation are risk factors for non-contact anterior cruciate ligament injuries (20). Hence, we thought that the menisci would be affected by rotational deformities. Nevertheless, in this study, we could not find any relationship between the rotational alignment with the menisci. Therefore, the rotational alignment does not seem to be a possible factor of meniscal tears.

Q angle is an important indicator of biomechanical function and normal alignment of the lower extremity. *Q angle* is measured as the angle between lines connecting the anterior superior iliac spine to the center of the patella and the tibial tuberosity to the center of the patella. Excessive *Q angle* has been identified as a potential risk factor for knee injuries

(21,22). The *Q angle* has been proposed as a risk factor for anterior cruciate ligament injury and patellofemoral pain syndrome (20,23). Additionally, Rauh et al. reported that the risk of initial lower extremity injury was elevated 70% in runners with Q-angle >20°. However, Park et al. showed that greater *Q angle* may not be a risk factor of patellofemoral pain syndrome (24). In this study, we found that the *Q angle* was significantly higher in the patient groups than control groups. Our findings suggest that the relationship may exist between Q-angle and meniscus tear. Therefore, the *Q angle* seems to be a possible factor of meniscal tears. In our study, MRI was not obtained for the contralateral knee in patients. Perhaps, asymptomatic meniscal tears may be observed contralateral knee in patients. However, we did not have the opportunity.

Some limitations of this study should be noted. First, it is the limited number of cases. Second, it had a cross-sectional design. Third, the MRI correlation was not performed, since we did not have the opportunity to the MRI correlation. We think that further studies with larger groups are needed to investigate the meniscal tears and its relation with the rotational alignments in the future.

Conclusion

In conclusion, we observed that there was no difference in the rotational alignments with the *Q angle* in the lower limb in the patient with isolated meniscal tears compared the lower limb with knees in healthy men. Lower extremity torsional deformities and the *Q angle* disorders have not been considered as a primary etiological factor for of the meniscus tears. These features may be contributed to the current situation only secondary.

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Tables:

Table 1. Lower extremity rotational measurements and *Q angles* of both sides of subjects.

	Group 1	Group 2	Group 3	Group 4	ANOVA *P*
Femoral anteversion	10.9±6.8°	10.7±7.2°	11.6±7.3°	10.5±7.2°	*P*>0.05
Tibial torsion	22.7±6.7°	24.6±6.5°	24.8±8.2°	25.4±7.2°	*P* >0.05
Q angle	16.0±5.9° *	14.8±5.7° *	9.8±2.3°	9.6±2.3°	*P* >0.05

* *P*<0.001 versus Group 3 and Group 4.

Figure legends:

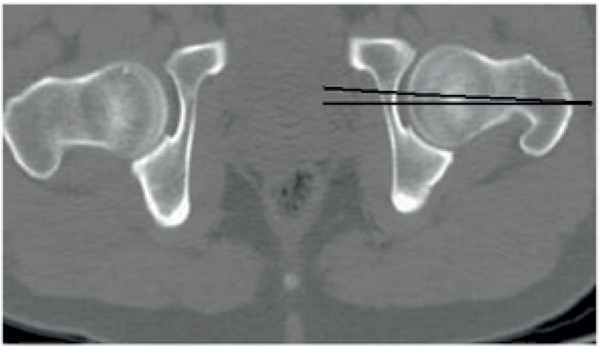

Figure 1. In the proximal femur, the first reference line was drawn through the middle of femoral neck.

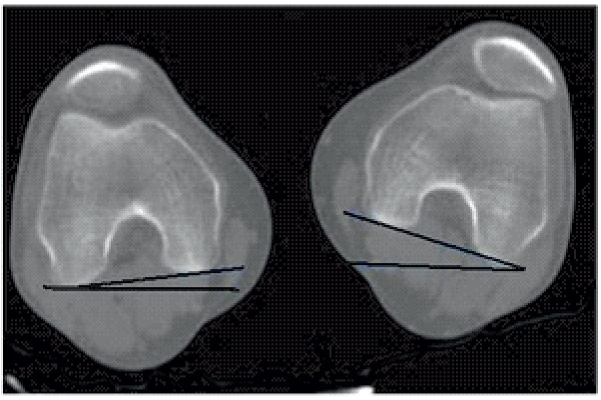

Figure 2. The second reference line was drawn through posterior border of condyles of the distal femur.

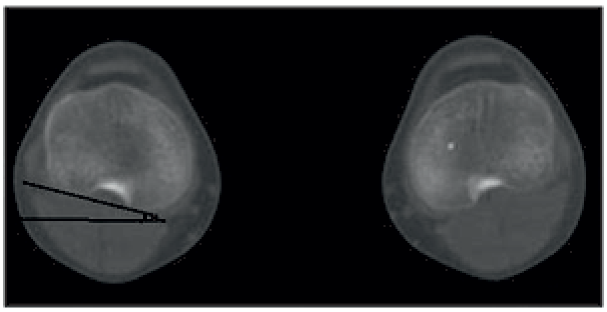

Figure 3. The third reference line was drawn through posterior border of proximal tibial condyles.

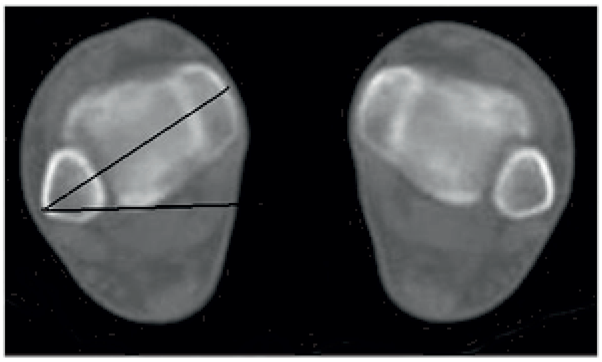

Figure 4. In the distal tibia, the fourth reference transverse line was drawn through the middle of medial and lateral malleoli.

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