



Relationship Between Trochlear Dysplasia and Chondromalacia Patellae

Troklear Displazi ve Kondromalazi Patella Arasındaki İlişki

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Abstract

Objective: Purpose of the study is to analyze the association between trochlear dysplasia and chondromalacia patellae.

Method: Knee magnetic resonance imaging of 191 patients (103 female and 88 male, mean age: 33±3.1, range: 18-49) with trochlear dysplasia were involved in the retrospective study. Patients without trochlear dysplasia (100 female and 91 male, mean age: 31±4.2 years, range: 18-49) were considered as the controls. Trochlear dysplasia was classified (type A, type B, type C, type D). Tibial tuberosity-trochlear groove distance was detected. Chondromalacia patellae was examined separately at the medial and lateral facet.

Results: The distribution of trochlear dysplasia was as follows; type A (50.2%), Type B (30.3%), type C (13.6%), type D (5.9%). Chondromalacia patellae was detected in 81 (42.4%) of patients with trochlear dysplasia and in 39 (20.4%) of the controls ($p<0.05$). Chondromalacia patellae was significantly more frequent at the lateral facet. There was significant association between the type of trochlear dysplasia and chondromalacia patellae. As the degree of dysplasia increases, the frequency of chondromalacia patellae increases ($p<0.05$).

Conclusion: Trochlear dysplasia and degree of trochlear dysplasia is a significant risk factor for chondromalacia patellae especially in lateral facet.

Keywords: Cartilage, chondromalacia patellae, knee, trochlear dysplasia

Öz

Amaç: Bu çalışmanın amacı, troklear displazi ile kondromalazi patella arasındaki ilişkiyi araştırmaktır.

Yöntem: Retrospektif çalışmaya troklear displazili 191 hastanın (103 kadın ve 88 erkek, ortalama yaş: 33±3,1, dağılım: 18-49) diz manyetik rezonans görüntülemesi dahil edildi. Troklear displazisi olmayan hastalar (100 kadın ve 91 erkek, ortalama yaş: 31±4,2 yıl, dağılım: 18-49) kontrol olarak kabul edildi. Troklear displazi sınıflandırıldı (tip A, tip B, tip C, tip D). Tibial tuberosity-troklear groove mesafesi ölçüldü. Kondromalazi patella medial ve lateral fasette ayrı ayrı incelendi.

Bulgular: Troklear displazi dağılımı şu şekildeydi; tip A (%50,2), tip B (%30,3), tip C (%13,6), tip D (%5,9). Troklear displazili hastaların 81'inde (%42,4), kontrol grubun 39'unda (%20,4) kondromalazi patella saptandı ($p<0,05$). Kondromalazi patella lateral fasette anlamlı olarak daha sıklıkla saptandı. Troklear displazi tipi ile kondromalazi patella arasında anlamlı bir ilişki saptandı. Displazi derecesi arttıkça kondromalazi patella sıklığı da artmaktadır ($p<0,05$).

Sonuç: Troklear displazi ve troklear displazi derecesi özellikle lateral faset düzeyindeki kondromalazi patella için önemli bir risk faktörüdür.

Anahtar kelimeler: Diz, kartilaj, kondromalazi patella, troklear displazi

Introduction

Trochlear dysplasia (TD) refers to the pathological appearance in the morphology and depth of the femoral trochlear groove. It is a condition associated with patellofemoral instability and is classified into 4 types by

Dejour (1,2). Chondromalacia patella (CP) is characterized by degeneration of the patellar cartilage and is a common cause of pain in the anterior region of the knee (3). There are some studies investigating the relationship between CP and TD in the literature in terms of patellar and trochlear



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cartilage damage. In addition to this relationship, in our study, relationship of CP with the grade of TD and patellar translation was examined. There is no study investigating this situation.

The aim of present study was to investigate the CP in patients with TD and evaluate whether there were relation between CP and grade of TD and patellar translation. In our opinion, the prevalence of CP significantly increases in patients with TD compared to the general population.

Materials and Methods

2230 knee MR examinations performed at our institution between February 2022 and July 2022 were reviewed. One hundred ninety-one patients with TD between the ages of 18-49 were identified. Patients without TD with the same number and age range were considered as the control group. TD was graded according to Dejour classification (type A, type B, type C, and type D). Type A: Shallow trochlea, type B: Flat trochlea, type C: Asymmetry of trochlear facets with a hypoplastic medial condyle and type D: Asymmetry of trochlear facets plus cliff pattern (4,5). CP were evaluated in accordance with Modified International Cartilage Repair Society classification, grade 0 indicates normal cartilage; grade 1 indicates superficial fissuring and softening; grade 2 indicates <50% depth to the subchondral plate; grade 3 indicates >50% depth into the subchondral plate; and grade 4 indicates penetration into the subchondral plate (6). The presence of CP in the patients was examined separately at the medial and lateral facet. A statistically significant difference in terms of CP between the two patient groups and the existence of a correlation between the degree of dysplasia and CP were investigated.

Tibial Tuberosity-Trochlear Groove (TT-TG) distance was also measured. TT-TG distance measured less than 15 mm considered as normal. Measurements were divided into 3 groups; <15 mm, 15-20 mm and >20 mm (7). Postoperative knee MR examinations, presence of previous history of acute trauma, history of rheumatologic diseases, subjects older than 50 years due to risk of degenerative osteoarthritis and insufficient MR were excluded.

All procedures performed in studies involving human participants were in accordance with the ethical standards of the Institutional Research Committee (Bezmialem Vakif University Faculty of Medicine, reference number: 15.03.2022-E.54758) and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. In keeping with the policies for a retrospective review, informed consent was not required.

Magnetic Resonance Imaging (MRI) Protocol

Unenhanced MRI of the knee was performed using a 1.5-T MR unit (Siemens, Avanto, Erlangen, Germany) with a knee coil a 20- to 26 cm FOV, and a 4-mm slice thickness with a 1-mm gap and a 320x256 matrix. Sequences used were sagittal T2 turbo spin echo (TR 2,300, TE 82, FA 150), sagittal proton density with fat saturation (TR 2140, TE 41, FA 150), coronal proton density with fat saturation (TR 2450, TE 41, FA 150), axial proton density with FS (TR 3330, TE 47, FA 150), and sagittal T1 SE (TR 307, TE 22, FA 150).

Statistical Analysis

Statistical analyses were performed using IBM SPSS 20.0. In statistical analysis, Pearson chi-squared test (χ^2) or Fischer's Exact test, was used to compare the distribution of categorical data relative to each other. A p-value <0.05 was considered to show a statistically significant result.

Results

In our study, there were 191 patients with TD (103 female and 88 male, mean age: 33±3.1, range: 18-49) and 191 patients without TD (100 female and 91 male, mean age: 31±4.2 years, range: 18-49). The distribution of patients with TD was; type A [96/191(50.2%)], type B [58/191 (30.3%)], type C [26/191 (13.6%)], type D [11/191 (5.9%)] (Figure 1). CP was detected in 81 (42.4%) of patients with TD, and it was significantly higher compared to the control group. Chondromalacia was detected in 51 patients (26.7%) at the lateral facet and in 30 (15.7%) patients at the medial facet, and 17 (8.9%) had chondromalacia at both the medial and lateral facets (p<0.05). It was significantly higher only in the lateral facet compared to the controls (Figure 2). CP was detected in 39 (20.4%) of the control group. Chondromalacia was detected in 16 patients (8.3%) at the lateral facet



Figure 1. Type B femoral trochlear dysplasia in 28 year-old-man. Axial PD and sagittal T1 W images shows flat trochlea (arrow)

and in 23 patients (12.1%) at the medial facet, and 7 had chondromalacia at both the medial and lateral facet (Table 1). There was statistically significant association between the CP and type of TD. As the degree of dysplasia increases, the frequency of CP increases ($p < 0.05$) (Table 2).

TT-TG values were; TT-TG <15 mm [115/191 (60.2%)], TT-TG: 15-20 mm [59/191 (30.8%)], TT-TG > 20 mm (17/191 (9%)). Although there was no statistically significant association between the TT-TG and CP, the highest rate of CP was in the patients with TT-TG distance >20 mm (Table 3).

Discussion

The main parameters of present study shows that the risk of CP increases in cases with TD. Our study showed increased incidence (42%) of CP in young-middle age patients with TD, compared to controls and general population stated in the literature. Variable CP prevalence rates such as 20.1 or 40.7 have been reported (8,9). There are some studies in the literature investigating the relationship between CP and patellofemoral instability. In study of Lu et al. (10), stated that the risk of CP is increased in patients with abnormal patellar height. In study of Dursun et al. (11), relationship between CP and patella type was investigated and they found an increased risk of CP in patients with type 2 and type 3 patella. Fan et al. (12) reported that thickness of lateral trochlear cartilage decreases in patients with TD. In study of Jungmann et al. (13), stated that patellar and trochlear cartilage volume decreased in patients with TD. In our study, unlike these studies, the presence of CP was specifically examined separately at medial and lateral facet levels, rather than patellar cartilage thickness or volume

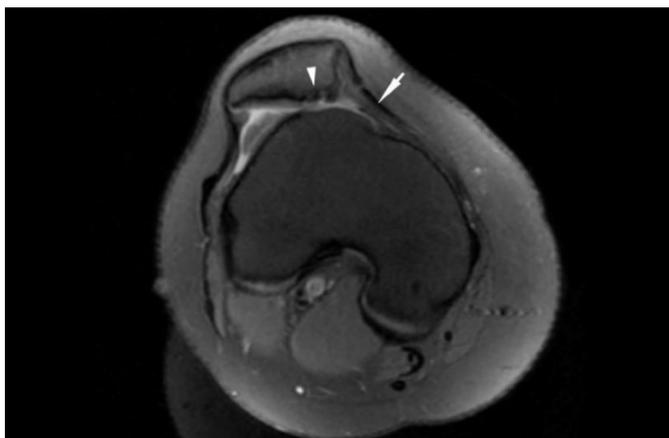


Figure 2. Axial PD image shows cartilage defect at the lateral patellar facet (arrowhead) and significant flattened trochlear groove (arrow) in a patient with trochlear dysplasia. Also lateral patellar tilt was seen

measurement in patients with TD. Also, differently, the relationship between grade of TD, patellar translation (TT-TG distance) and CP was investigated. In line with the studies mentioned above, we think that TD and TD grade increases the risk of CP especially in lateral facet. This may be related to the degree of dysplasia increasing patellofemoral instability. There was no significant correlation between CP and TT-TG, but the CP ratio was higher in patients with TT-TG >20 mm. This may be related with sample size of these patients (n=17). However, this high rate may support that patellar instability increases the risk of CP.

Study Limitations

This study has some limitations. First, there is no interobserver agreement test. Second, small number of Type D patients.

Conclusion

This study shows increased risk of CP especially in lateral patellofemoral region in young patients with TD. Increasing degree of TD can be a serious risk factor for early or advanced stage patellofemoral degeneration. Early and appropriate treatment for high-grade TD is important for the control of patellofemoral degeneration.

Table 1. Distribution of CP in patients with TD and without TD

	MF	LF	MF + LF
TD (+) n=191	30 (15.7%)	51 (26.7%)	17 (8.9%)
TD (-) n=191	23 (12.1%)	16 (8.3%)	7 (3.6%)

MP: Medial facet, LF: Lateral facet, CP: Chondromalacia patella, TD: Trochlear dysplasia

Table 2. CP distribution by type of trochlear dysplasia

	CP (+)	CP (-)	Total
Type A	36 (37.5%)	60 (62.5%)	n=96 (100%)
Type B	25 (43.1%)	33 (56.9%)	n=58 (100%)
Type C	13 (50%)	13 (50%)	n=26 (100%)
Type D	7 (63.6%)	4 (36.4%)	n=11 (100%)
Total	81 (10%)	110 (100%)	191

CP: Chondromalacia patella

Table 3. CP distribution by TT-TG distance

	CP (+)	CP (-)	Total
TT-TG <15 mm	50 (43.4%)	65 (56.6%)	n=15 (100%)
TT-TG: 15-20 mm	23 (38.9%)	36 (61.1%)	n=59 (100%)
TT-TG >20 mm	8 (47%)	9 (53%)	n=17 (100%)

CP: Chondromalacia patella, TT-TG: Tibial tuberosity-trochlear groove

Ethics

Ethics Committee Approval: All procedures performed in studies involving human participants were in accordance with the ethical standards of the Institutional Research Committee (Bezmi Alem Vakıf University Faculty Of Medicine, reference number: 15.03.2022-E.54758) and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Informed Consent: In keeping with the policies for a retrospective review, informed consent was not required.

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