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Association Between Patellar Morphology and Chondromalacia Patellae: A Magnetic Resonance Imaging Study

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Abstract

Objective: Chondromalacia patellae (CP) is a common cause of anterior knee pain and is considered a multifactorial disorder involving mechanical, anatomical, and biomechanical factors. This study aimed to evaluate magnetic resonance imaging (MRI)-derived patellar morphological parameters in patients with and without CP.

Methods: This retrospective single-center study included 889 patients who underwent knee MRI from January 2024 to May 2026. Patients were divided into two groups according to the presence or absence of MRI findings compatible with CP. The Wiberg classification, Wiberg index, Wiberg angle, and patellar linear dimensions were evaluated.

Results: CP was detected in 278 patients (31.3%), while 611 patients (68.7%) constituted the non-CP group. No significant difference was observed in gender distribution between groups (P=0.151). The CP group was significantly younger than the non-CP group (40.15 ± 10.8 vs. 45.8 ± 12.4 years, P <0.001). The distribution of Wiberg patellar types differed significantly between groups (P=0.021), and type III morphology was more frequent in patients with CP. The Wiberg index was significantly lower in the CP group compared with the non-CP group (0.61 ± 0.08 vs. 0.73 ± 0.07, P <0.001). The anteroposterior diameter was significantly larger (21.18 ± 2.3 mm vs. 19.74 ± 2.1 mm, P <0.001), whereas the transverse diameter was significantly smaller in the CP group (40.33 ± 3.4 mm vs. 41.68 ± 2.9 mm, P <0.001). No significant difference in craniocaudal diameter was found between groups (P=0.137).

Conclusion: Several MRI-derived patellar morphological parameters were independently associated with CP after adjustment for age and sex. These findings provide additional information regarding patellar morphology in patients with CP; however, further prospective studies incorporating clinical symptoms and outcomes are required to determine their value in routine MRI interpretation

Keywords: Cartilage degeneration, MRI, Wiberg classification, patellofemoral joint

INTRODUCTION

Chondromalacia patellae (CP) is defined by a progressive degradation and softening of the patellar articular cartilage. It is a prevalent cause of anterior knee pain. While CP is especially prevalent among young adults and physically active individuals, it can manifest at any age.[1,2]

The development of CP depends on numerous factors. Mechanical overloading, repetitive microtraumas, and anatomical variations of the patellofemoral joint contribute to cartilage degeneration. Not with standing its significant prevalence (ranging from approximately 24% to 79%), the precise mechanisms governing the onset of CP remain inadequately comprehended.[3-5]

Magnetic resonance imaging (MRI) is the preferred modality for assessing patellofemoral cartilage. It also facilitates the assessment of bone morphology in addition to evaluating cartilage integrity. MRI can assess morphological features such as patellar dimensions, facet configuration, angular measurements, and various other morphometric indices.[6-8] Variations in these anatomical parameters can influence patellofemoral biomechanics by modifying contact-pressure distribution and joint alignment. As a result, individuals may become increasingly vulnerable to cartilage degeneration.[9,10]

The Wiberg classification is a prominent system for categorizing patellar morphology, focusing on the proportional dimensions of the medial and lateral articular surfaces.[11] Recent studies have indicated that specific patellar morphologies may correlate with patellofemoral instability, malalignment, and degenerative cartilage alterations.[12-15] Nonetheless, the existing evidence concerning the correlation between patellar morphology and CP remains inconsistent. This is due to the fact that the majority of these studies have concentrated exclusively on morphological parameters or have involved relatively small patient cohorts.[11,15,16]

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Previous studies have investigated the relationship between patellar morphology and CP using qualitative classifications or selected morphometric measurements. However, many of these studies evaluated a limited number of morphological parameters or included relatively small study populations.[4,5,8,11,15] Furthermore, the Wiberg classification, Wiberg index, Wiberg angle, and patellar linear dimensions have rarely been assessed together within the same MRI cohort. An integrated evaluation of these qualitative and quantitative features may provide a more comprehensive description of the morphological differences between patients with and without MRI-defined CP.

This study aims to compare MRI-derived morphological characteristics of the patella, including the Wiberg classification, index, angle, and linear dimensions, between groups with and without CP. The study aims to identify potential correlations between distinct patellar morphological characteristics and the occurrence of CP, as well as factors associated with patellofemoral cartilage degeneration.

MATERIAL AND METHODS

Ethical Approval

Ethical approval was obtained from the Erzincan Binali Yıldırım University Non-Interventional Clinical Research Ethics Committee prior to the beginning of this study (approval number: 2026-10/10, date: 21.05.2026). All patients granted written informed consent for the publication of this article utilizing their anonymous data.

Study Population

Our study included patients aged 18 to 59 who underwent knee MRI examinations (in all cases, reason for the imaging is pain in the knee) in our radiology department from January 1, 2024, to May 1, 2026. The exclusion criteria were as follows: patients <18 years or ≥60 years of age; a history of knee surgery; the presence of trauma, fractures, or severe deformities; the presence of benign or malignant masses in the knee joint; the presence of severe arthritis or inflammatory/rheumatological diseases; and MRI scans exhibiting significant motion artifacts or inadequate image quality.

A total of 1,133 potentially eligible patients were identified during the study period. Of these, 244 patients were excluded because of previous knee surgery (n=77), trauma (n=53), severe arthritis (n=44), infection (n=12), benign or malignant mass involving the knee (n=31), or inadequate MRI quality (n=27). The exclusion categories were mutually exclusive, and each patient was assigned to only one category. Eight hundred and eighty-nine patients were included in the final analysis after applying the eligibility criteria (Figure 1).

MAIN POINTS

- Chondromalacia patellae (CP) is a common cause of anterior knee pain, and both biomechanical and anatomical factors are believed to contribute to its development.
- Patellar morphology can be assessed using qualitative and quantitative measurements obtained from routine knee magnetic resonance imaging (MRI).
- Wiberg-type distribution and Wiberg index differed between patients with and without MRI-defined CP.
- Further prospective studies incorporating symptoms, functional outcomes, and treatment-related data are needed to determine the clinical utility of these morphological measurements.

By "severe arthritis," we refer to patients with advanced tibiofemoral osteoarthritis characterized by widespread or full-thickness tibiofemoral cartilage loss and significant degenerative bone changes on MRI. Trauma was defined as an acute or recent major knee injury associated with the current MRI examination. Traumatic injury was identified using the available clinical records, MRI referral information, and imaging findings. Patients with fractures, acute osteochondral injuries, patellar dislocation, acute ligament disruption, or extensive traumatic bone contusions were excluded. A remote history of minor trauma without persistent structural abnormalities on MRI was not considered an exclusion criterion.

Each patient underwent only one knee MRI scan. No scans were conducted more than once. A single-sided knee examination was conducted for each patient.

The patients were subsequently categorized into two groups: the CP group and the control group. Patients in the CP group displayed signal alterations in the patellar cartilage on knee MRI scans, indicative of CP, while the control group consisted of patients without CP.

Magnetic Resonance Imaging Protocol

All MRI scans were obtained utilizing a 1.5-Tesla MRI scanner (MAGNETOM Aera; Siemens Healthineers, Erlangen, Germany). The parameters used in the acquisition protocol for each MRI sequence are shown in Table 1.

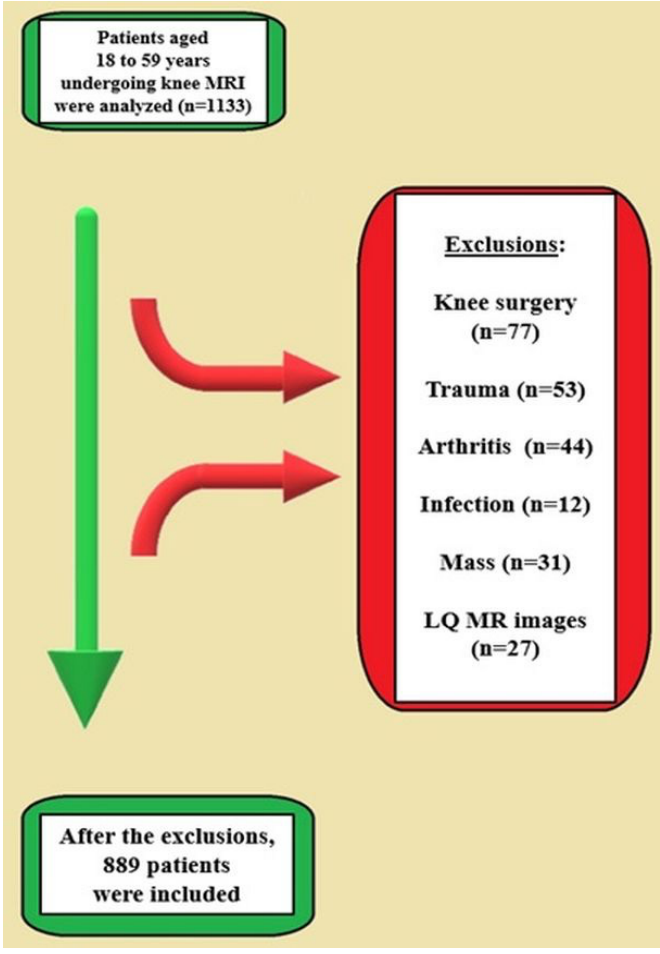


Figure 1: The study's workflow process.

MRI, magnetic resonance imaging; LQ, low quality; MR, magnetic resonance.

Wiberg classification, Wiberg index, Wiberg angle, and the anteroposterior and transverse patellar diameters were assessed on the axial fat-suppressed PD-weighted sequence at the level of the maximum patellar transverse diameter. The craniocaudal patellar diameter was measured on the midpatellar sagittal sequence.

Image Analysis and Measurements

All MRI images were collectively evaluated by two musculoskeletal radiologists possessing 11 and 19 years of experience. After identifying the presence of CP through a retrospective analysis of knee MRI images, the two radiologists determined the patellar subtype according to the Wiberg classification, calculated the Wiberg index and angle, and measured the patellar dimensions in three planes. Each measurement was obtained using electronic calipers within the picture archiving and communication system. The less experienced observer conducted all measurements while the more experienced observer oversaw each phase. Discrepancies were reconciled via consensus. A radiology resident recorded the patients' demographic data, including age and sex, for analysis.

The Wiberg classification (Figure 2) delineates patellar types as follows: in type I, the medial and lateral facets are of equal dimensions and both exhibit a slight concavity. In type II, the medial facet is smaller than the lateral facet and has a convex or flat configuration. In type III, the medial facet is significantly smaller than the lateral facet and exhibits a convex or steep configuration.[17]

The Wiberg index and Wiberg angle were measured using axial MRI images taken at the level of the largest mediolateral diameter of the patella. Measurements were performed in accordance with the literature.[18] The Wiberg index was determined as the ratio of the length of the medial patellar facet to that of the lateral patellar facet (Figure 3A). The Wiberg angle is defined as the angle formed between the medial and lateral articular facets of the patella, with its apex situated at the deepest point of the patellar ridge (Figure 3B). Patellar diameters were calculated using three distinct measurements: medio-lateral (transverse), anterior-posterior, and cranio-caudal (Figure 3C, D).

Statistical Analysis

All analyses were performed using IBM SPSS Statistics 25.0 (IBM Corp., Armonk, NY, USA). The distribution of continuous variables was evaluated using histograms, Q-Q plots, skewness and kurtosis values, and formal normality tests, where appropriate. Because formal normality tests may detect trivial deviations in large samples, distributional

Table 1. Technical Parameters of the Knee MRI Acquisition Protocol for Each Sequence

Sequence	Plane	TR (ms)	TE (ms)	NEX	FOV (mm)	ST (mm)	VS (mm)
T1-weighted	Sagittal	1110	9.7	1	180	3	0.5 x 0.5 x 3
PD-weighted fat-saturated	Axial	3440	30	2	180	3	0.6 x 0.6 x 3
PD-weighted fat-saturated	Coronal	2390	20	2	200	4	0.6 x 0.6 x 4
PD-weighted fat-saturated	Sagittal	3060	38	1	180	3	0.7 x 0.7 x 3

TR, time of repetition; TE, time of echo; NEX, number of excitations; FOV, field of view; ST, slice thickness; VS, voxel size; PD, proton density.

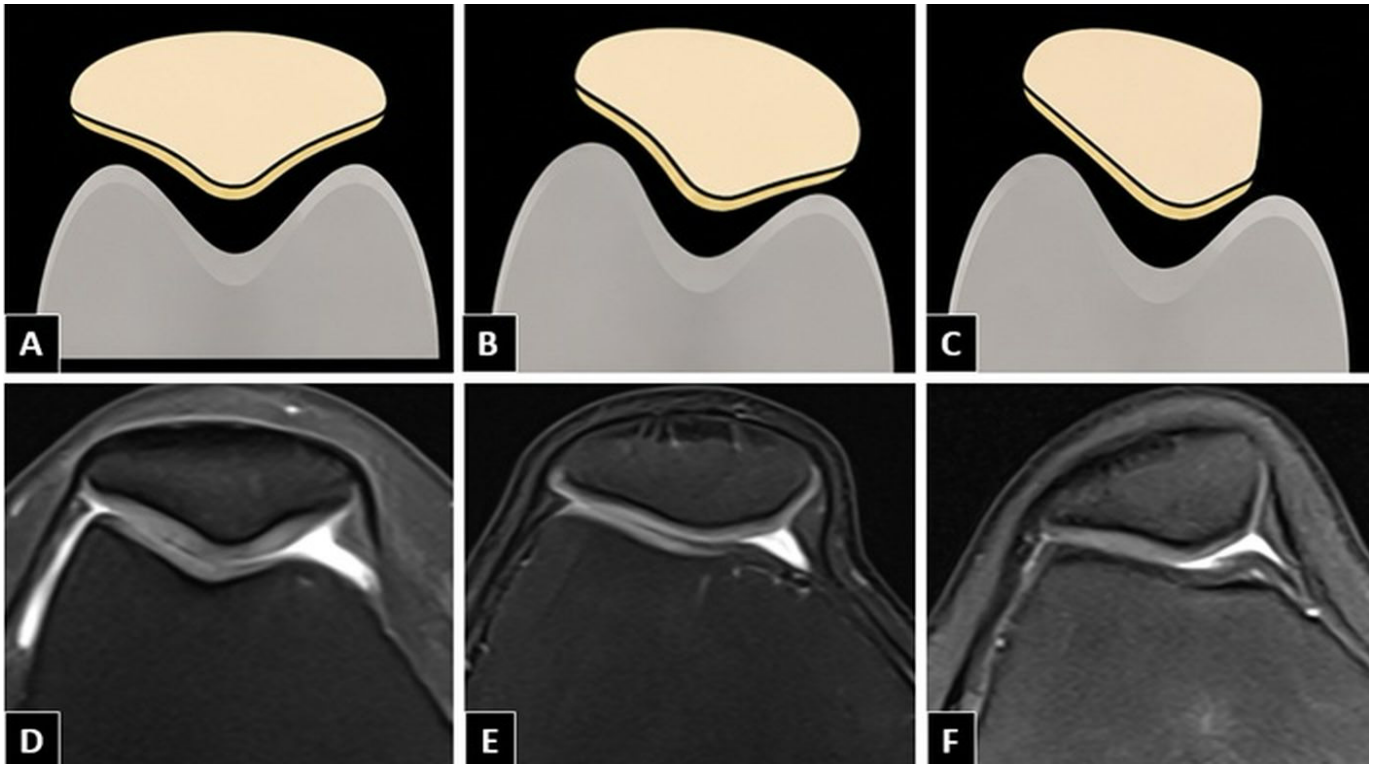


Figure 2: Wiberg classification of patella shape. Illustrative diagrams (A-C) and corresponding axial MRI images (D-F) demonstrating Wiberg type I (A, D), type II (B, E), and type III (C, F) patellae.

MRI, magnetic resonance imaging.

assumptions were determined using a combined visual and numerical assessment. Homogeneity of variances was assessed using Levene's test. Continuous variables were expressed as mean ± standard deviation, while categorical variables were presented as frequencies and percentages.

Comparisons of continuous variables between the CP and the non-CP groups were performed using the Independent Samples t-test. Categorical variables, including gender and Wiberg patellar classification, were compared using the Pearson chi-square test. For post-hoc comparisons following statistically significant differences in the Wiberg classification, pairwise comparisons were performed using a Bonferroni correction to control for multiple testing.

Univariable binary logistic regression analyses were initially performed to evaluate the associations of demographic and patellar morphological parameters with the presence of CP. Subsequently, two multivariable logistic regression models were constructed using CP status as the dependent variable. Because Wiberg type and Wiberg index represent closely related anatomical characteristics, they were not included in the same model. Model 1 included Wiberg morphology categorized as type III versus types I and II combined, whereas Model 2 included the Wiberg index rather than the Wiberg type. Both models were adjusted for age, sex, Wiberg angle, and anteroposterior, transverse, and craniocaudal patellar diameters. Multicollinearity was assessed using tolerance and variance inflation factor values. The results were reported as odds ratios (ORs) with 95% confidence intervals (CIs). ORs were calculated per 0.1-unit increase for the Wiberg index and per one-unit increase for age, Wiberg angle, and patellar dimensions. A two-sided *P*-value of <0.05 was considered statistically significant.

RESULTS

A total of 889 participants were included in this study. The mean age of the study cohort, comprising 364 (40.9%) males and 525 (59.1%) females, was 44.03 ± 12.2 years. CP was identified in 278 individuals (31.3%). The remaining 611 participants constituted the control group. Table 2 shows the demographic data and patellar morphological characteristics of patients in these two groups.

The prevalence of CP was 28.6% in males and 33.1% in females. However, Pearson's chi-square test indicated no significant difference in gender distribution between the CP and control groups (χ^2=2.09, *P*=0.151). The control group was significantly older than the CP group (45.8 ± 12.4 vs. 40.15 ± 10.8 years), as determined by an Independent Samples t-test (*P* <0.001).

Across both groups, type 2 patella was the most common, while type 3 was the least common. The distribution of Wiberg patella types exhibited a statistically significant difference between both groups (*P*=0.021). Type III was more prevalent in the CP group. The overall distribution of Wiberg patellar types differed significantly between the CP and non-CP groups (*P*=0.021). Post-hoc pairwise comparisons were performed using Pearson's chi-square test with a Bonferroni-adjusted significance threshold of (*P* <0.0167). Significant differences were observed between types I and III (*P*=0.015) and between Types II and III (*P*=0.009), whereas no significant difference was observed between types I and II (*P*=0.918). These findings indicate that the overall difference was primarily related to the higher relative frequency of type III morphology in the CP group.

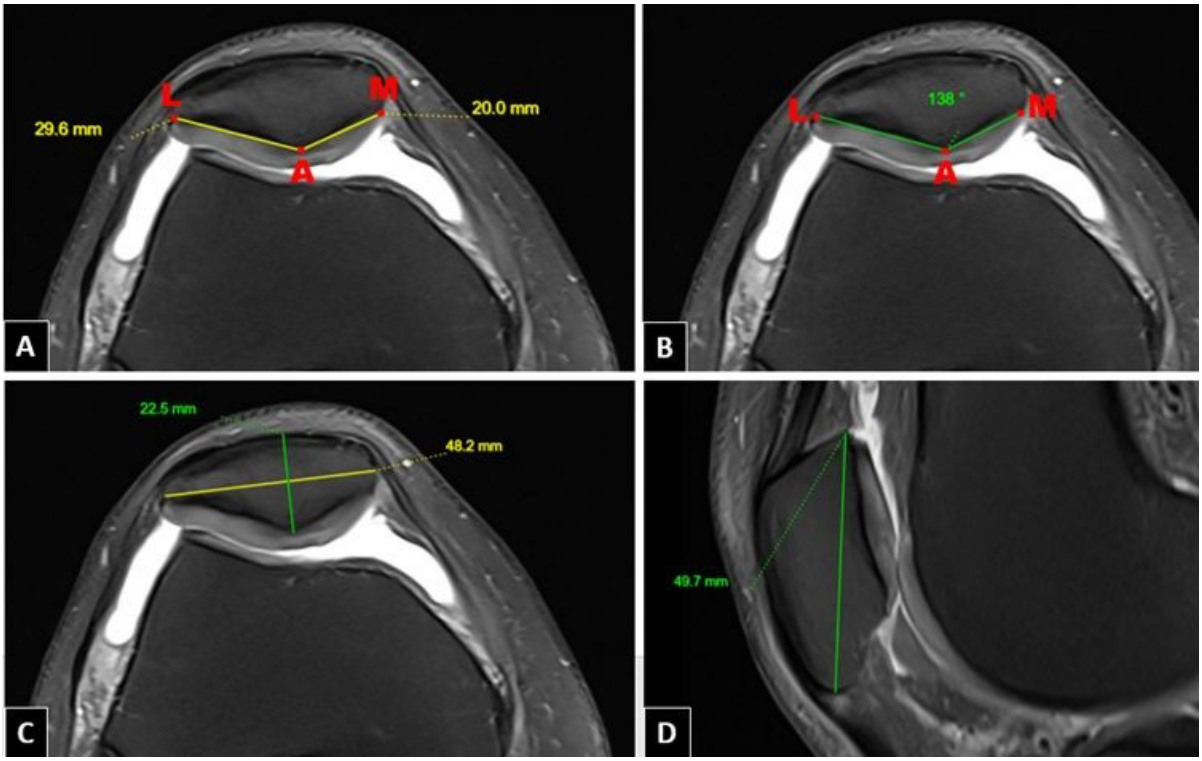


Figure 3: Measurement of patellar morphologic parameters on axial (A-C) and sagittal (D) MR images. A) Measurement of the Wiberg index (MA/LA), calculated as the ratio between the medial patellar facet width (MA) and lateral patellar facet width (LA). B) Measurement of the Wiberg angle, defined as the angle formed by lines extending from the median ridge to the medial and lateral margins of the patellar articular surface (∠LAM). C) Measurement of patellar transverse diameter (maximum mediolateral width-yellow line) and anteroposterior diameter (green line) on the axial MR image. D) Measurement of patellar craniocaudal diameter (patellar height-green line) on the sagittal MR image.

MR, magnetic resonance.

The Wiberg index was significantly lower in the CP group than in the control group (P <0.001). The Wiberg angle did not differ significantly between the two groups.

The comparison of patellar dimensions between the groups revealed notable differences in both the anteroposterior and transverse diameters. The anteroposterior diameter in the CP group was significantly larger than in the control group (21.18 ± 2.3 mm vs. 19.74 ± 2.1 mm, P <0.001), while the transverse diameter was significantly smaller (40.33 ± 3.4 mm vs. 41.68 ± 2.9 mm, P <0.001). Conversely, there was no statistically significant difference in the patellar height (craniocaudal diameter) between the two groups (42.76 ± 3.6 mm vs. 43.14 ± 3.5 mm, P=0.137).

In the univariable logistic regression analysis, younger age was associated with higher odds of CP (OR=0.96 per year, 95% CI: 0.95-0.97, P <0.001). Wiberg type III morphology was associated with higher odds of CP compared with types I and II combined (OR=1.65, 95% CI: 1.16-2.36, P=0.006). Each 0.01-unit increase in the Wiberg index was associated with lower odds of CP (OR=0.80, 95% CI: 0.79-0.82, P <0.001). A greater anteroposterior diameter was associated with higher odds of CP (OR=1.36 per mm, 95% CI: 1.27-1.46, P <0.001), whereas a greater transverse diameter was associated with lower odds of CP (OR=0.87 per mm, 95% CI: 0.82-0.91, P <0.001). Sex, Wiberg angle, and craniocaudal diameter were not significantly associated with CP in the univariable analyses (Table 3).

Two complementary multivariable models were constructed to avoid the simultaneous inclusion of the Wiberg type and the Wiberg index. In Model 1, Wiberg type III morphology remained independently associated with CP (aOR=1.32, 95% CI: 1.25-1.38, p=0.019). Greater anteroposterior diameter (aOR=1.16 per mm, 95% CI: 1.06-1.25, p=0.015) and smaller transverse diameter (aOR=0.91 per mm, 95% CI: 0.87-0.94, P=0.025) also remained associated with CP. In Model 2, each 0.01-unit increase in the Wiberg index was associated with lower odds of CP (aOR=0.89, 95% CI: 0.82-0.93, P=0.005). Anteroposterior and transverse diameters also remained associated with CP in this model (aOR=1.18, 95% CI: 1.05-1.30, P=0.030; aOR=0.93, 95% CI: 0.88-0.98, P=0.019, respectively). Age, sex, Wiberg angle, and craniocaudal diameter were not independently associated with CP in either model.

Table 2. Demographic and MRI-Derived Patellar Morphologic Characteristics of Patients with and Without Chondromalacia Patellae

		Chondromalacia Patella Group (n=278)	Non-CP Control Group (n=611)	*P*-value
Gender Male Female	 n (%) n (%)	 104 (37.4) 174 (62.6)	 260 (42.6) 351 (57.4)	0.151
Age	Mean ± SD	40.15 ± 10.8	45.8 ± 12.4	<0.001
Wiberg classification Type I Type II Type III	 n (%) n (%) n (%)	 97 (34.9) 118 (42.4) 63 (22.7)	 232 (37.9) 287 (47) 92 (15.1)	0.021
Wiberg index	Mean ± SD	0.61 ± 0.08	0.73 ± 0.07	<0.001
Wiberg angle (∘)	Mean ± SD	128.4 ± 5.7	129.1 ± 4.9	0.097
Patella diameters Anteroposterior Transverse Cranio-caudal (height)	(mm) Mean ± SD Mean ± SD Mean ± SD	 21.18 ± 2.3 40.33 ± 3.4 42.76 ± 3.6	 19.74 ± 2.1 41.68 ± 2.9 43.14 ± 3.5	 <0.001 <0.001 0.137

Percentages reported for sex and Wiberg type represent column percentages within each study group.
SD, standard deviation; mm, millimeter; MRI, magnetic resonance imaging.

Table 3. Univariable and Multivariable Associations Between Demographic and Patellar Morphological Parameters and the Presence of Chondromalacia Patellae

	Univariable OR (95% CI)	*P*-value	Model 1 aOR (95% CI)	*P*-value	Model 2 aOR (95% CI)	*P*-value
Age	0.96 (0.95-0.97)	<0.001	1.01 (0.97-1.05)	0.105	1.01 (0.96-1.05)	0.194
Gender Female vs. male	1.24 (0.93-1,66)	0.148	1.20 (0.43-1.85)	0.605	1.33 (0.26-1.83)	0.492
Wiberg type III vs. types I-II	1.65 (1.16-2.36)	0.006	1.32 (1.25-1.38)	0.019	-	-
Wiberg index	0.80 (0.79-0.82)	<0.001	-	-	0.89 (0.82-0.93)	0.005
Wiberg angle	0.97 (0.95-1.02)	0.077	0.90 (0.76-1.09)	0.115	0.88 (0.63-1.15)	0.213
Anteroposterior diameter	1.36 (1.27-1.46)	<0.001	1.16 (1.06-1.25)	0.015	1.18 (1.05-1.30)	0.030
Transverse diameter	0.87 (0.82-0.91)	<0.001	0.91 (0.87-0.94)	0.025	0.93 (0.88-0.98)	0.019
Craniocaudal diameter	0.97 (0.93-1.01)	0.098	0.98 (0.57-1.44)	0.151	0.95 (0.49-1.42)	0.185

The presence of CP was the dependent variable. Model 1 included age, sex, Wiberg type III morphology, Wiberg angle, and patellar linear dimensions. Model 2 included the same variables, with the Wiberg index replacing Wiberg type. Wiberg type III morphology was compared with combined types I and II. ORs for the Wiberg index were calculated per 0.01-unit increase, whereas ORs for age, Wiberg angle, and patellar dimensions were calculated per 1-unit increase.
OR, odds ratio; aOR, adjusted odds ratio; CI, confidence interval; CP, chondromalacia patellae.

DISCUSSION

This study demonstrated that several MRI-derived patellar morphological parameters were associated with CP in a large cohort. In two complementary multivariable models, Wiberg type III morphology and a lower Wiberg index were each independently associated with CP. Greater anteroposterior diameter and smaller transverse diameter were also independently associated with CP, whereas age, sex, Wiberg angle, and craniocaudal diameter were not independently associated. These findings suggest that facet configuration and the proportional geometry of the patella may be more relevant to CP than demographic characteristics or patellar height alone.

The prevalence of CP in our study cohort was 31.3%. Dursun et al.[4] reported a prevalence of 79.5% for CP in a study conducted in our country. The exclusion of individuals over the age of 60 from our study may have contributed to this disparity. In an alternative study involving a larger cohort, Arslan et al.[5] reported an overall prevalence of CP at 34.1%. We contend that another factor contributing to the low prevalence of CP observed in our study is the exceedingly broad and rigorous implementation of exclusion criteria.

Previous studies have indicated gender-related differences in the progression of CP. Arslan et al.[5] identified the presence of CP at any stage in 46.5% of women and 24% of men, indicating a higher prevalence among women. Kong and Yu[19] reported that CP was more frequently detected in women than in men, with rates of 39.58% and 19.19%, respectively. Although these studies indicate a greater prevalence of CP in women, some other research suggest no significant correlation between CP and gender.[15,20] Sirik and Uludag[20] reported comparable CP rates between men and women. Although the sex distribution did not differ significantly between the CP and non-CP groups in our study, sex was retained in the multivariable model because of its potential biological and biomechanical relationships with patellofemoral morphology and cartilage degeneration. Therefore, the role of sex was evaluated using adjusted analyses rather than being determined solely by the univariable comparison.

There are also studies in the literature that have found that CP patients are younger.[5,11] In our study, the CP group was significantly younger than the non-CP group, and younger age was associated with CP in the univariable analysis. However, age was no longer significant in either multivariable model after adjustment for sex and the evaluated patellar morphological parameters. This attenuation indicates that the unadjusted age difference did not independently account for CP status when morphological characteristics were considered simultaneously. Nevertheless, because of the retrospective and cross-sectional design, the present findings cannot determine whether the observed morphology preceded cartilage degeneration or whether it developed partly as a consequence of remodeling.

Patellar morphology can alter the distribution of mechanical forces acting on the articular cartilage by affecting patellofemoral joint congruency.[12,15] In our study, Wiberg type II was the most common morphology in both groups, whereas Wiberg type III patellae were observed more frequently in patients with CP. Type III morphology remained independently associated with CP after adjustment for age and sex. This finding suggests that the higher frequency of type III morphology in the CP group was not explained solely by the demographic differences between the groups. Wiberg type III morphology was more frequent in the CP group and associated with approximately 32% higher odds of CP in the adjusted model. In the complementary model, each 0.1-unit increase in the Wiberg index was associated with an 11% reduction in the odds of CP. These findings are anatomically concordant because both type III morphology and a lower Wiberg index reflect a relatively small medial patellar facet. The predominance of type III morphology in the CP group can be explained by a reduction in the size of the medial surface and an impaired alignment between the patella and the trochlear groove. A smaller medial surface may reduce patellofemoral contact stability and alter load distribution during knee movement, which may be associated with differences in local cartilage loading. Panni et al.[12] demonstrated that patellar shape may be an associated factor for patellar instability and emphasized the role of morphological variations in patellofemoral disorders. Similarly, previous MRI-based studies have reported associations between patellar morphology and the prevalence of CP.[11,15]

The Wiberg index and Wiberg angle offer quantitative insights into the geometry of the patellar surfaces.[11] Our study revealed that the Wiberg index was significantly lower in the CP group than in the control group, whereas the Wiberg angle did not differ significantly. Our findings regarding the Wiberg index reveal that a relative reduction in the contribution of the medial surface significantly affects patients with CP. Prior morphological studies have demonstrated that quantitative assessments of patellar facets can yield supplementary insights into patellofemoral alignment and morphology, surpassing qualitative classification systems.[19,21]

Our study revealed significant differences between groups, not only in facet morphology but also in the linear dimensions of the patella. In patients with CP, the anteroposterior diameter was markedly larger, whereas the transverse diameter was considerably smaller. Greater anteroposterior diameter remained associated with CP in both multivariable models, corresponding to approximately a 16-18% increase in the odds of CP per 1-mm increase in diameter. Conversely, a greater transverse diameter was associated with lower odds of CP, suggesting that a relatively narrower patella may accompany CP. An increased anteroposterior dimension may affect patellar retention within the trochlear groove, whereas a decreased transverse dimension may reduce the joint contact area and potentially increase local cartilage loading. In contrast to our findings, Kong and Yu[19] indicated that patellar depth measurements were decreased in the CP group. In that study, patellar depth was assessed solely from the portion of the patella positioned within the trochlear groove, rather than by the anteroposterior diameter.

Interestingly, no significant differences in craniocaudal patellar diameter (patellar height) were observed between groups. This finding suggests that not all patellar dimensions contribute equally to cartilage degeneration and that parameters reflecting facet configuration and mediolateral morphology may play a more significant role in the development of CP. Indeed, previous studies have also emphasized the importance of shape-related parameters over dimensional measurements alone in understanding patellofemoral disorders.[4,11,22]

The MRI assessment of CP primarily concentrates on identifying cartilage irregularities. Our study demonstrates that evaluating patellar morphology provides additional insights into potential mechanical factors that may lead to cartilage degeneration. Recognizing morphological patterns linked to CP may enhance the understanding of individual susceptibility and aid in a more thorough assessment of patients exhibiting anterior knee pain. This does not mean that morphological abnormalities should be considered independent predictors of CP. Cartilage degeneration likely arises from a complex interaction of anatomy, biomechanics, repetitive loading, and individual predilection.[1,16]

Study Limitations

Our study possesses some strengths, including the assessment of qualitative and quantitative morphological data on the patella derived from MRI within a relatively large cohort; however, it is evident that it also has several limitations. The retrospective, single-center design may restrict the generalizability of the results. While MRI facilitates precise evaluation of patellar morphology and cartilage irregularities, biomechanical factors including patellar tracking, lower extremity alignment, muscle strength, activity level, and body mass index were not assessed. A further limitation is that the control group comprised individuals lacking CP findings on MRI rather than completely asymptomatic volunteers in the non-CP group; thus, subtle clinical differences between the groups must not be overlooked. Ultimately, extensive long-term studies are required to ascertain whether particular patellar morphological characteristics predispose individuals to the development of CP or if they are merely secondary adaptations linked to cartilage degeneration.

CONCLUSION

Wiberg Type III morphology and a lower Wiberg index were associated with CP in separate multivariable models, while greater anteroposterior and smaller transverse patellar dimensions were also associated with CP after adjustment. These findings suggest that patellar facet configuration and proportional morphology may accompany patellar cartilage degeneration.

Data Availability Statement: The datasets created and/or analyzed during the present study are not publically available due to patient privacy and confidentiality concerns.

Ethics Committee Approval: Ethical approval was obtained from the Erzincan Binali Yıldırım University Non-Interventional Clinical Research Ethics Committee prior to the beginning of this study (approval number: 2026-10/10, date: 21.05.2026).

Informed Consent: All patients granted written informed consent for the publication of this article utilizing their anonymous data.

Author Contributions: Surgical and Medical Practices – K.B.M.; Concept – V.K.; Design – K.B.M.; Data Collection or Processing – V.K.; Analysis or Interpretation – K.B.M.; Literature Search – V.K.; Writing – K.B.M.

Declaration of Interests: The authors declare that there is no conflict of interest

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