

# Evaluation of Ishiofemoral Space and Quadratus Femoris Space by Magnetic Resonance Imaging

## *Ishiofemoral ve Quadratus Femoris Boşluklarının Manyetik Rezonans Görüntüleme İle Değerlendirilmesi*

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### ABSTRACT

**Objective:** We aimed to evaluate the ischiofemoral (IF) space and quadratus femoris (QF) space by magnetic resonance imaging in a Turkish population.

**Material and method:** A total of 488 magnetic resonance images of the hip were evaluated by one radiologists to measure IF and QF distances. The data were grouped according to gender and side (right / left) and statistically compared.

**Results:** The median value of the IF and QF space width was 25.00 (95% CI; 23.00 to 27.00) and 20.00 (95% CI; 17.00 to 22.00), respectively. There was no significant difference between the left and right side in terms of IF and QF distance ( $p = 0.99$ ,  $p = 0.92$ ) (Table 1), but a significant difference was found between male and female patients ( $p < 0.0001$ ,  $p < 0.0001$ , respectively) (Table 1).

**Conclusion:** In the Turkish population investigated, the IF and QF distance was lower in women than in men. Therefore, the risk of impingement is considered to be higher in the female population.

**Key Words:** Ishiofemoral Space; Quadratus Femoris Space; Magnetic Resonance Imaging

### ÖZET

**Amaç:** Türkiye popülasyonunda ischiofemoral (IF) ve quadratus femoris (QF) boşluklarını manyetik rezonans görüntüleme ile değerlendirmeyi amaçladık.

**Gereç ve Yöntem:** Kalça eklemine ait toplam 488 manyetik rezonans görüntüsü, IF ve QF mesafelerini ölçmek için bir radyolog tarafından değerlendirildi. Veriler cinsiyet ve tarafa göre (sağ/sol) gruplandırılıp istatistiksel olarak karşılaştırıldı.

**Bulgular:** IF ve QF boşluk genişliğinin ortanca değeri sırasıyla 25.00 (% 95 CI; 23.00 - 27.00) ve 20.00 (% 95 CI; 17.00 - 22.00) idi. Sol ve sağ taraf arasında IF ve QF mesafesi açısından anlamlı fark yoktu ( $p = 0.99$ ,  $p = 0.92$ ) (Tablo 1), ancak kadın ve erkek hastalar arasında anlamlı bir fark bulundu ( $p < 0.0001$ ,  $p < 0.0001$ ) (Tablo 1).

**Sonuç:** İncelenen Türk popülasyonunda, IF ve QF mesafesi kadınlarda erkeklere göre daha düşüktü. Bu nedenle, kadın nüfusta sıkışma sendromu riskinin daha yüksek olduğu düşünülmektedir.

**Anahtar Kelimeler:** Ishiofemoral Boşluk; Quadratus Femoris Boşluğu; Manyetik Rezonans Görüntüleme

### Introduction

Due to the complex anatomical structure of the gluteal and hip region, the undiagnosed hip and gluteal pain is common (1-2). The cause of this pain remains unknown in about one-third of the patients (1). Impingement syndromes of this region have begun to be identified by new imaging methods (1-2). Pathologies of the quadratus femoris (QF) associated with these impingement syndromes are detected using advanced imaging methods (2). Although ischiofemoral impingement was first described in 1977 (3), there is still limited

data concerning a normal ischiofemoral distance. Therefore, we aimed to determine the anatomical distances of ischiofemoral (IF) space and QF space in a Turkish population by magnetic resonance imaging. This study is significant in terms of having the largest series of cases in the literature.

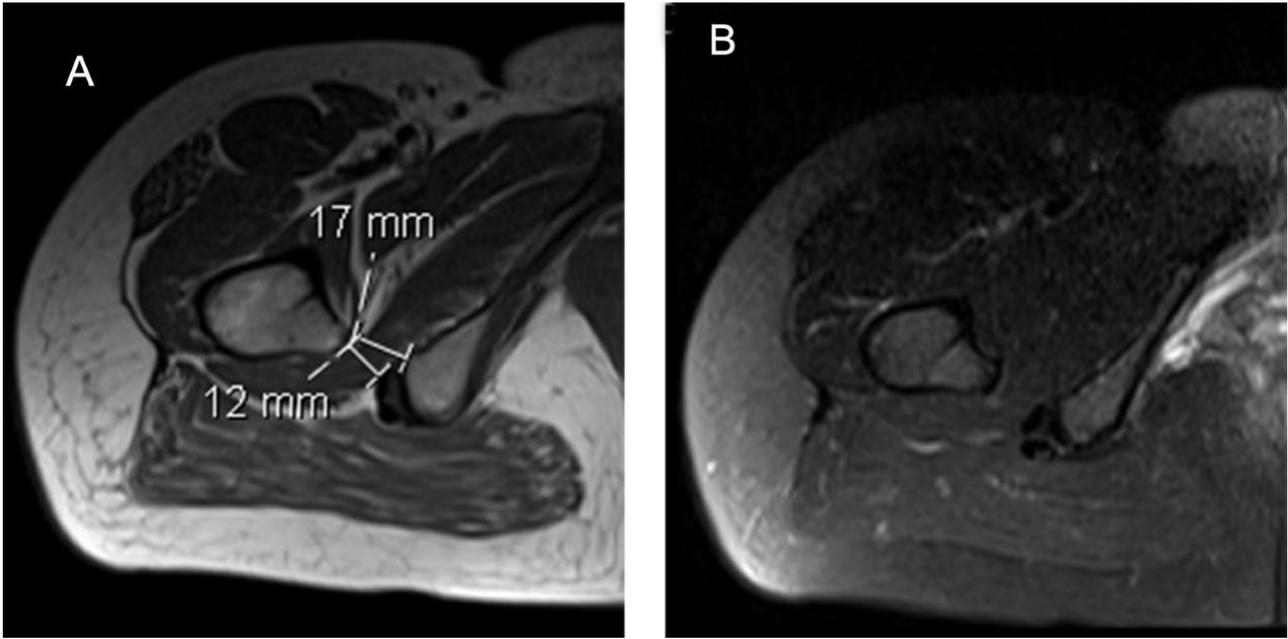
### Material and Method

Permission was obtained from the Institutional Review Board of our institution to perform this study. The initial study sample included 320

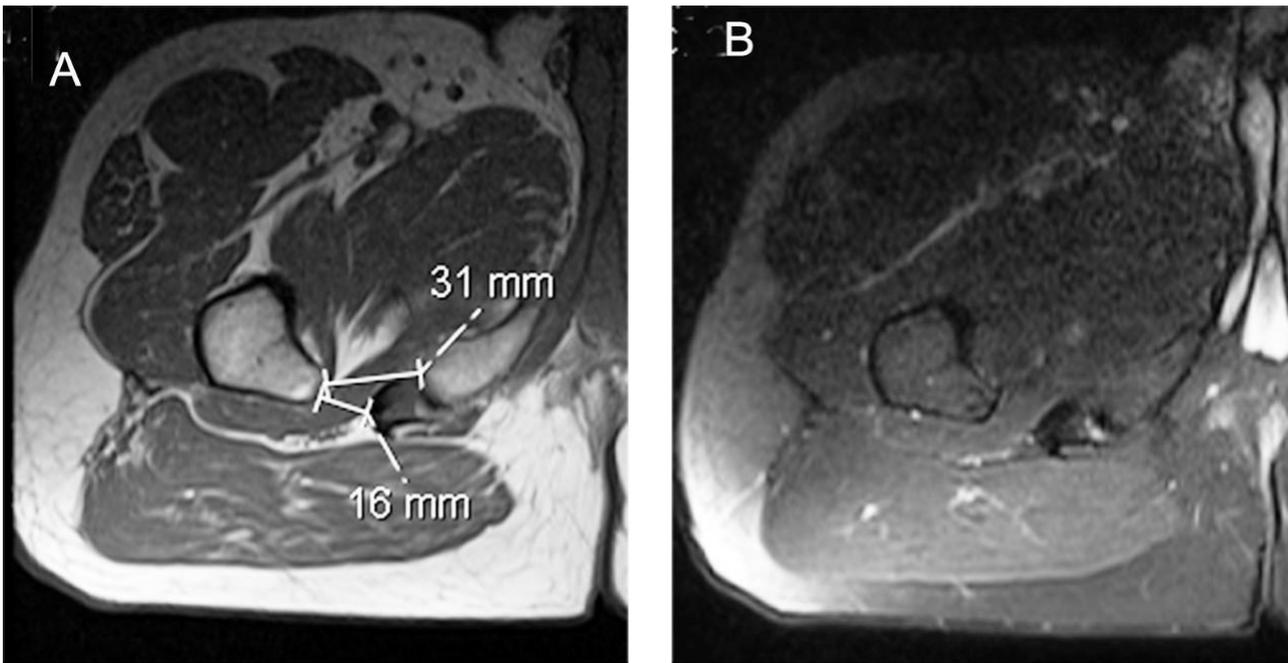
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**Fig. 1.** An example of the shorter IF and QF distances in female patients (A). No pathology observed in the quadratus femoris muscle (B)



**Fig. 2.** An example of the longer IF and QF distances in male patients (A). No pathology observed in the quadratus femoris muscle (B)

patients aged 18 to 65 years, who had undergone hip magnetic resonance (MR) imaging in our hospital. Of the total 640 hips, 152 hips were excluded from the study based on the following criteria; history of hip or pelvic surgery (n=27), hip trauma and fracture (n=21), painful hip requiring medical treatment (n=81), and QF muscle pathologies revealed by MR imaging (n=23). The MR images of 488 hips were evaluated. The age and gender of the patients were recorded. All hip MR imaging examinations were

performed on a 1.5 T scanner (Intera, Philips, Eindhoven, Netherlands) using a body coil. The volunteer was placed in a supine position on the MR examination table with a neutral position of the hip. Axial T1-weighted spin-echo sequence and axial proton density-weighted spin-echo sequence images were obtained (matrix, 256×256; field of view (FOV), 40 cm; slice thickness, 3 mm).

All hip MRI evaluations were performed by one radiologist with six years of experience in

**Table 1.** Data and statistical results of ischiofemoral space and quadratus femoris space

Ischiofemoral space	Male	Female	p	Right	Left	p
Median	28	23	$p < 0.0001$	25	25	$p = 0.99$
95% CI for the median	27.00 to 29.00	21.00 to 23.00		23.00 to 27.00	23.00 to 27.00	
Quadratus femoris space	Male	Female	p	Right	Left	p
Median	23	15.5	$p < 0.0001$	20	20	$p = 0.92$
95% CI for the median	22.00 to 25.00	14.00 to 16.00		16.00 to 23.00	17.00 to 22.00	

musculoskeletal imaging (G.P.) using software. As initially described by Torriani et al. (4), the measurements of the IF and QF spaces were respectively undertaken as follows: the smallest distance between the medial cortex of the lesser trochanter and lateral cortex of the ischial tuberosity, and the smallest space for passage of the QF muscle delimited by the superolateral surface of the hamstring tendons and the posteromedial surface of the iliopsoas tendon or lesser trochanter (Figure 1A). 4 weeks later, the same radiologist re-evaluated. The averages of these values obtained by the radiologist were used to calculate the IF and QF distances.

All the reported p values were calculated bidirectionally and a p value of  $<0.05$  was considered statistically significant. All statistical analyses were performed using statistical software (Medcalc ver. 12, Mariagerke, Belgium). The normality of the data was assessed by the Kolmogorov-Smirnov test. The intra-agreement value in terms of the IF and QF measurements was determined by Kappa values. The Mann-Whitney U test and the Wilcoxon test were used to compare IF and QF according to gender and the affected side (right / left), respectively.

## Results

The mean age of the patients was  $45.21 \pm 17.02$ . The number of male patients was 232, and the male/female ratio was 0.48. The median values of the IF and QF spaces were 25.00 mm (95% CI; 23.00-27.00 mm) and 20.00 mm (95% CI; 17.00-22.00 mm), respectively. The kappa compliance values were 0.82 for IF and 0.80 for QF indicating good agreement. In terms of the IF and QF distances, there was no significant difference between the affected and unaffected sides (right/left) ( $p=0.99$  and  $p=0.92$ , respectively) (Table 1); however, a significant difference was

observed between male and female patients ( $p < 0.0001$  and  $p < 0.0001$ , respectively) (Table 1) (Figure 1 and 2).

## Discussion

IF and QF distances are important for the identification of impingement syndromes, which is a major cause of hip pain (5). Impingement syndromes occur with compulsion of the QF muscle, which lies between the lesser trochanter of the femur and the ischial tuberosity/hamstring tendon origin (5). Impingement causes edematous signal changes or partial ruptures in QF. MR imaging has recently become a gold standard for evaluating this region (6). However, since these distances differ between populations, an optimal IF or QF distance has not been determined (2). In an MR study with 10 cases, Finnoff JT found the IF distance to be 28.25 mm (6). Özdemir ZM evaluated 418 cases and reported the IF and QF distances to be  $25.6 \pm 7.5$  mm  $15.6 \pm 5.4$  mm, respectively (7). Sussman WI and et al. found that the IF distance was  $23.5 \pm 4.7$  mm and the QF distance was  $20.4 \pm 5.6$  mm in a cadaver study of 16 cases (2). These studies confirm the presence of differences between populations.

Özdemir ZM and et al. undertook the MR evaluation of 418 hips of clinically asymptomatic patients in a Turkish population (7). Even in asymptomatic cases, impingement syndromes are detectable by MR findings in humans (7). In the current study, we excluded the patients with clinical and radiological impingement syndromes to determine the normal ranges of IF and QF distances. To the best of our knowledge, this is the first study in the literature that measured the normal values for the two parameters.

According to the results of this study, there was no significant difference in the IF and QF distances between the right and left hip. However,

a significant difference was found between male and female patients, with the latter having shorter IF and QF distances. This may be due to two reasons; first, in the Turkish population, the body size of women is generally smaller than that of men. Second, the gynecoid type of pelvis, which is more common in women is wider than the android type of pelvis, which is more common in men (2,4,8,9). As a result, the distance between the ischial tuberosities in the gynecoid pelvis is greater and the pubic arch angle is greater than 100 degrees (2,4,8). These anatomical differences result in the ischiofemoral distance being shorter in women. Studies in the literature support this finding (2,10).

In conclusion, the results of this study showed that MR imaging can be effectively used to measure IF and QF distances in the Turkish population. In the evaluated sample, there was a difference in the IF and QF distances according to gender. For this reason, women can be considered as a risk group in terms of the development of impingement syndromes.

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