

Limited Hip Rotational Range of Motion Is Associated with Kinesiophobia in Patients with Femoroacetabular Impingement

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Abstract

Background

The severity of acetabular cartilage or labral injuries does not always correspond with clinical symptoms. This observational, cross-sectional study aimed to investigate the association between kinesiophobia levels and clinical findings in patients with femoroacetabular impingement syndrome.

Methods

Twenty-two individuals with symptomatic femoroacetabular impingement syndrome (12 females, 10 males; aged 18–65 years) were included in the study. Radiographic assessments comprised the alpha and the lateral center-edge angle. Kinesiophobia was assessed using the Tampa Scale for Kinesiophobia (TSK), pain intensity with the Visual Analog Scale, and pressure pain threshold using an algometer. Hip range of motion was measured using the Clinometer mobile application, hip function with the Harris Hip Score, and lower-extremity strength with the 30-Second Sit to Stand Test.

Results

A statistically significant inverse relationship was observed between kinesiophobia levels and hip external rotation ($p = 0.006$) and internal rotation range of motion ($p = 0.027$). Kinesiophobia levels were also significantly associated with the Harris Hip Score ($p = 0.012$). However, no relationship was found between kinesiophobia levels and the lateral center-edge angle ($p = 0.824$) or the alpha angle ($p = 0.150$). Additionally, no association was identified between the 30-Second Sit to Stand Test and either the lateral center-edge angle ($p = 0.967$) or the alpha angle ($p = 0.943$).

Conclusions

Kinesiophobia was significantly associated with hip rotation range of motion and functional status, whereas radiographic measures showed no meaningful clinical relevance.

Trial registration:

ClinicalTrials.gov ID: NCT06198829

1. BACKGROUND

Femoroacetabular impingement syndrome (FAIS) is one of the most common causes of hip pain. This condition may present as a cam deformity, characterized by excessive osseous formation at the femoral head–neck junction; a pincer deformity, resulting from excessive acetabular coverage of the femoral head; or a mixed type in which both deformities coexist.¹ Abnormal contact between the acetabulum and the femoral head–neck junction can lead to significant pain and discomfort, potentially resulting in acetabular labral or chondral injuries.² Radiographic imaging plays a fundamental role in the definitive

diagnosis of FAIS.³ The Dunn view provides optimal visualization of the anterolateral aspect of the femoral head–neck complex, where cam deformities are typically observed, while the anteroposterior (AP) pelvic radiograph effectively depicts femoral and acetabular morphology.⁴ The lateral center-edge angle (LCEA or Wiberg angle), measured on the AP pelvic radiograph, reflects acetabular coverage, whereas the alpha angle is commonly used to evaluate cam morphology.^{4,5} However, it is important to recognize that abnormal morphology does not necessarily indicate pathological tissue damage; therefore, clinical symptoms and physical examination findings should be integrated into a comprehensive diagnostic approach.⁶

Individuals with femoroacetabular impingement syndrome (FAIS) often exhibit altered hip biomechanics, particularly during functional activities such as walking, squatting, and stair climbing. Pain may lead these individuals to adopt compensatory movement patterns—including maintaining the hip in a flexed position or reducing load on the affected limb—which can present as a Trendelenburg gait.⁷ These compensations may, over time, contribute to the development of kinesiophobia, defined as an excessive and irrational fear of movement driven by the belief that physical activity will exacerbate pain or cause reinjury.⁸ A study published in 2022 reported that higher levels of kinesiophobia in individuals with FAIS were associated with poorer physical performance and more unfavorable patient-reported outcomes. The same study also demonstrated that elevated kinesiophobia levels correlated with reduced hip-related quality of life as well as lower overall quality of life.⁸ Grace et al. demonstrated that the severity of acetabular cartilage or labral injuries is not always associated with more pronounced clinical symptoms.⁹ However, biochemical changes detected in the femoral cartilage by MRI may provide insight into symptom progression.⁹ In the study conducted by Ratcliff et al., no association was found between radiographic findings and symptoms in individuals with FAIS, and it was emphasized that the sources of hip pain should be further investigated.¹⁰

In this context, the present study aimed to evaluate the relationship between kinesiophobia and radiological and clinical parameters in individuals with FAIS. It was hypothesized that kinesiophobia would be significantly associated with hip joint range of motion and functional status in patients with femoroacetabular impingement syndrome.

2. METHODS

2.1. Trial design

This study was designed as an observational, cross-sectional study. The study was ethically reviewed and approved by the Istanbul Medipol University Non-Interventional Ethics Committee on the date of 25.12.2023 with the file number E-10840098-772.02-7986. The study was registered in the ClinicalTrials database (ID: NCT06198829) Reporting of the present cross-sectional study was guided by the STROBE statement.¹¹

2.2. Participants

Individuals aged 18–65 years who were diagnosed with femoroacetabular impingement syndrome, were symptomatic, had not undergone surgical intervention in the hip region within the past year, and had not previously participated in a physical therapy program, and who presented to the Orthopedics and Traumatology Department of Acibadem Atasehir Hospital between February and June 2024 were included in the study. Individuals with a history of psychiatric or mental illness, as well as those with other hip disorders that may present with symptoms similar to femoroacetabular impingement syndrome—such as osteoarthritis, trochanteric bursitis, or hip dysplasia—were excluded from the study. Verbal and written informed consent was obtained from all patients who agreed to participate in the study. Demographic information of the participants was recorded. The study size was determined by the number of patients who met the inclusion criteria during the data collection period.

To reduce potential sources of bias, participants were consecutively enrolled based on predefined inclusion and exclusion criteria. Radiographic assessments were conducted using standardized protocols, and validated instruments were employed to evaluate kinesiophobia and clinical outcomes. All measurements were performed by a single trained assessor, and data analyses were carried out using predefined statistical procedures.

2.3.Outcome Measures

2.3.1.The Tampa Scale of Kinesiophobia

The Tampa Scale of Kinesiophobia (TSK) is a questionnaire developed by Miller et al.¹² and validated in Turkish by Yilmaz et al.¹³, assessing fear of movement/(re)injury and fear-avoidance parameters associated with work-related activities. The scale consists of 17 items rated on a 4-point Likert scale. The total score ranges from 17 to 68, with higher scores indicating a higher level of kinesiophobia.

2.3.2.The Harris Hip Score

The Harris Hip Score (HHS) was developed by Harris to evaluate hip disability¹⁴ and was validated in Turkish by Çelik et al.¹⁵ The scale assesses parameters such as pain, function, absence of deformity, and range of motion. The questionnaire contains 10 main items and is scored out of a maximum of 100 points. Scores of 90–100 are considered excellent, 80–89 good, 70–79 fair, and below 70 poor.¹⁶

2.3.3.The 30-Second Sit to Stand Test

The 30-Second Sit to Stand Test (30STS) was used to measure the functional lower-limb strength of the participants. With arms crossed over the chest, participants stood up fully from a 44 cm-high chair and sat back down repeatedly for 30 seconds. After ensuring that the test was clearly understood, the score was recorded as the total number of full stands completed at a self-selected pace within 30 seconds.¹⁷

2.3.4.Range of Motion

Range of Motion (ROM) was measured using a mobile application called Clinometer (Plaincode app development and tech blog, Stephanskirchen, Germany), which has been shown by Wheyte et al.¹⁸ to

have excellent reliability for assessing hip extension and rotation. For hip flexion, the participant was in the supine position, with the pivot point placed on the greater trochanter, aligning the bottom corner of the phone, and the moving arm of the device following the lateral midline of the femur. Hip extension was measured while the participant transitioned from a seated position into the Modified Thomas Test position, with the lateral edge of the phone placed on the anterosuperior region of the femur. For internal and external rotation, the participant was seated with the hip and knee at 90° flexion, the leg hanging freely, and the thigh stabilized. Measurements were taken from the neutral position into rotation.¹⁸ For internal and external rotation, the pivot point was aligned with the tibial tuberosity, placing the upper edge of the phone at this point, while the moving arm followed the tibial crest.¹⁹

2.3.5.Pain

Pain was assessed using both subjective and objective methods. Subjective pain was evaluated using the Visual Analog Scale (VAS).²⁰ The scale consisted of a 10 cm line with the endpoints labelled “No Pain” and “Unbearable Pain.” Participants were asked to mark their pain intensity at rest and during activities (e.g., squatting, stair climbing, walking) on separate lines. The distance in centimeters from the 0 point to the participant’s mark was measured and recorded.²¹ Objective pain was assessed using a pressure algometer (JTECH Commander, JTECH Medical, USA). After providing instructions and performing a demonstration on another body area, pressure was applied in kg/cm² using a device with a 1 cm round plastic tip to the groin and greater trochanter regions. When pressure was applied, the kg value indicated at the participant’s maximum tolerance point was recorded. Each measurement was repeated three times, and the average value was taken as the final score.²²

2.3.6.Radiography

Radiographic assessment was performed using Dunn view and Pelvis AP radiographs. Cam-type deformities were evaluated through the alpha angle measured on the Dunn view.²³ Pincer deformity was assessed on the Pelvis AP using the lateral center-edge angle.²⁴ Alpha angles $\geq 58^\circ$ and lateral center-edge angles $> 39^\circ$ were considered abnormal.

2.4.Statistical analysis

Statistical analysis was conducted using SPSS software version 23.0 (IBM, SPSS Inc., Chicago, IL). Normality was assessed using the Shapiro–Wilk test. Continuous variables obtained from the participants were presented as mean (X) and standard deviation (SD), while categorical variables were presented as frequency (N) and percentage (%). Pearson correlation analysis was performed. Correlation coefficients were interpreted as follows: 0.00–0.29 very weak; 0.30–0.49 weak; 0.50–0.69 moderate; 0.70–0.89 strong; 0.90–1.00 very strong. No missing data were observed for any of the analyzed variables. A p-value < 0.05 was considered statistically significant.

3. RESULTS

The demographic characteristics of the participants are presented in Table 1. A total of 22 symptomatic FAIS patients (12 females, 10 males; 18–65 years) were included in the study. Nineteen participants were university graduates. FAIS symptoms were present in the left hip in 54.5% of individuals, while 45.5% had right-sided involvement. The mean age of the participants was 39.77 ± 11.36 years, mean height was 173.36 ± 11.42 cm, mean body weight was 75.12 ± 17.17 kg, and mean BMI was 24.68 ± 3.79 kg/m² (Table 2).

Table 1
Participant Characteristics: Gender,
Education Level, and Symptomatic
Side

Variables	n	%
Gender		
Female	12	54.5
Male	10	45,5
Education Level		
High School	3	%13.6
University	19	%86.3
Symptomatic Side		
Right	10	%45.5
Left	12	%54.5

Table 2
Descriptive Statistics of Participants

Variables	Mean $\pm$ SD	Min.	Max.
Age (years)	39.77 $\pm$ 11.36	22	63
Height (cm)	173.36 $\pm$ 11.42	150	192
Body Weight (kg)	75.12 $\pm$ 17.17	44.6	107.2
BMI (kg/m ²)	24.68 $\pm$ 3.79	19	31.6
VAS-Rest	3.35 $\pm$ 2.93	0	9.1
VAS-Actv	6.82 $\pm$ 2.08	2	10
PPT-TM (kg)	9.94 $\pm$ 3.67	5	19
PPT-GR (kg)	7.43 $\pm$ 3.41	3	15.5
Alpha angle (°)	68.47 $\pm$ 6.87	57	82
LCEA (°)	35.13 $\pm$ 7.03	24	50
ROM-FLX (°)	104 $\pm$ 15.45	75	125
ROM-EXT (°)	12.6 $\pm$ 5.55	10	30
ROM-EXTR (°)	21.93 $\pm$ 6.69	9	35
ROM-INTR (°)	22.33 $\pm$ 5.62	13	33
TSK	40.47 $\pm$ 6.27	30	48
30STS	13.07 $\pm$ 2.46	9	17
HHS	71.14 $\pm$ 15.68	43.8	95
SD: Standard deviation, BMI: Body mass index, LCEA: Lateral center-edge angle, Min.: Minimum, Max.: Maximum, kg: kilogram, cm: centimeter, m ² : square meter, °: degree, %: percent, VAS: Visual Analog Scale, VAS-Rest: VAS at rest, VAS-Actv: VAS during activity, PPT-TM: Pressure pain threshold at trochanter major, PPT-GR: Pressure pain threshold at groin, ROM-FLX: Range of motion – flexion, ROM-EXT: Range of motion – extension, ROM-EXTR: Range of motion – external rotation, ROM-INTR: Range of motion – internal rotation, TSK: Tampa Scale of Kinesiophobia, 30STS: 30-Second Sit to Stand Test, HHS: Harris Hip Score			

No significant relationship was found between the alpha angle and TSK scores ($p = 0.150$) (Table 3). Similarly, no significant relationship was observed between the LCEA and TSK scores ($p = 0.824$) (Table 3). A moderate positive correlation was found between VAS scores at rest and during activity ($r = 0.562$, $p = 0.007$). A moderate negative correlation was observed between external rotation and VAS scores at rest ($r = -0.536$, $p = 0.010$). A low negative correlation was found between flexion and VAS scores during activity ($r = -0.426$, $p = 0.048$). A strong positive correlation was observed between pressure pain thresholds in the groin and greater trochanter regions ($r = 0.810$, $p < 0.001$). A moderate

negative correlation was found between TSK and external rotation ($r = -0.567$, $p = 0.006$), and a low negative correlation was found between TSK and internal rotation ($r = -0.470$, $p = 0.027$) (Table 4). A moderate negative correlation was found between HHS and TSK ($r = -0.527$, $p = 0.012$). A low positive correlation was observed between the 30-second sit to stand test and HHS ($r = 0.465$, $p = 0.029$). VAS scores at rest showed a moderate negative correlation with LCEA ($r = -0.584$, $p = 0.022$) and a low positive correlation with the alpha angle ($r = 0.494$, $p = 0.019$) (Table 5).

Table 3

Correlation analysis between kinesiophobia (TSK) and radiographic parameters (LCEA and alpha angle)

		TSK	LCEA	ALFA
TSK	r	1	-.063	.317
	p	-	.824	.150
LCEA	r	-.063	1	.132
	p	.824	-	.638
ALFA	r	.317	.132	1
	p	.150	.638	-
TSK: Tampa Scale of Kinesiophobia, LCEA: Lateral Center-Edge Angle, Alpha: Alpha Angle, r: Correlation coefficient, p: Significance level. Pearson correlation analysis was used; $p < 0.05$ was considered statistically significant				

Table 4
Correlation matrix of pain, pressure pain threshold, range of motion, and kinesiophobia

		VAS- Rest	VAS- Acvt	PPT- TM	PPT- GR	ROM- FLX	ROM- EXT	ROM- EXTR	ROM- INTR	TKS
VAS- Rest	r	1	0,562	,143	-,030	-,401	-,242	-0,536	-,158	,276
	p		,007**	,524	,895	,065	,278	,010*	,483	,214
VAS- Acvt	r	0,562	1	-,121	-,337	-0,426	-,095	-,289	,004	,138
	p	,007**		,593	,125	,048*	,675	,193	,985	,540
PPT- TM	r	,143	-,121	1	0,810	,232	0,488	,196	,223	-,300
	p	,524	,593		0,00**	,299	,021*	,381	,319	,175
PPT- GR	r	-,030	-,337	0,810	1	,259	,409	,372	,300	-,172
	p	,895	,125	0,00**		,244	,059	,088	,175	,443
ROM- FLX	r	-,401	-0,426	,232	,259	1	,092	,354	,096	-,383
	p	,065	,048*	,299	,244		,685	,106	,671	,078
ROM- EXT	r	-,242	-,095	0,488	,409	,092	1	,138	,101	-,177
	p	,278	,675	,021*	,059	,685		,540	,655	,432
ROM- EXTR	r	-0,536	-,289	,196	,372	,354	,138	1	0,498	-0,567
	p	,010*	,193	,381	,088	,106	,540		,018*	,006**
ROM- INTR	r	-,158	,004	,223	,300	,096	,101	0,498	1	-0,47
	p	,483	,985	,319	,175	,671	,655	,018*		,027*
TKS	r	,276	,138	-,300	-,172	-,383	-,177	-0,567	-0,47	1
	p	,214	,540	,175	,443	,078	,432	,006**	,027*	

VAS: Visual Analog Scale, VAS-Rest: VAS at rest, VAS-Actv: VAS during activity, PPT-TM: Pressure pain threshold at trochanter major, PPT-GR: Pressure pain threshold at groin, ROM-FLX: Range of motion – flexion, ROM-EXT: Range of motion – extension, ROM-EXTR: Range of motion – external rotation, ROM-INTR: Range of motion – internal rotation, TSK: Tampa Scale of Kinesiophobia, r: Correlation coefficient, p: Significance level, Pearson correlation analysis was used. *: p < 0.05, **: p < 0.01

Table 5
Relationships between functional capacity, kinesiophobia, and hip function outcomes

		30STS	TSK	HHS
30STS	r	1	-.245	0.465
	p		.271	.029*
TSK	r	-.245	1	-0.527
	p	.271		.012*
HHS	r	0.465	-0.527	1
	p	.029*	.012*	

30STS: 30-Second Sit to Stand Test, TSK: Tampa Scale of Kinesiophobia, HHS: Harris Hip Score

4. DISCUSSION

In our study aiming to examine the relationship between kinesiophobia and clinical and radiographic parameters in individuals with FAIS, significant associations were found between kinesiophobia levels and clinical parameters, whereas no significant relationships were observed with radiographic parameters.

The TSK scores of the individuals in our study were found to be higher compared to previous studies involving patients with FAIS.^{8,25,26} Sharma et al.²⁷ reported in their systematic review that pain beliefs (particularly fear-avoidance beliefs) and pain coping strategies vary across countries. In a study conducted among Turkish and Swedish patients with musculoskeletal pain, Turkish patients were found to report higher levels of pain intensity, duration, and frequency.²⁸ Consequently, in some populations, limiting movement in response to pain may be a more common coping strategy, which may lead to higher levels of kinesiophobia. Factors such as education, age, and gender may also contribute to these differences. Luque-Suarez et al.²⁹ reported that high kinesiophobia in chronic musculoskeletal pain is associated with greater pain, increased disability, and lower quality of life.

The inverse relationship found in our study between kinesiophobia and external and internal rotation range of motion indicates that as kinesiophobia levels increase, hip rotation range of motion decreases. It is known that individuals with FAIS exhibit reduced internal rotation, external rotation, and flexion range of motion.³⁰ The literature has also shown that patients with FAIS generate less external and internal rotation torque during walking compared to healthy individuals.³¹ Similar to other pathologies that lead to chronic pain, kinesiophobia in FAIS may originate from avoidance behavior toward movements that

provoke pain. Avoidance leads to activity limitation as a result of persistent fear related to pain and the negative thoughts and emotions associated with activity.³²

The inverse relationship observed between TSK scores and the Harris Hip Score (HHS) indicates that higher levels of kinesiophobia are associated with greater disability in individuals. Jochimsen et al.³³ reported in their 2021 study that higher levels of kinesiophobia in individuals with FAIS are associated with poorer functional outcomes. Additionally, it is known that both hip-related and general health-related quality of life are negatively affected by kinesiophobia in this population.⁸ The findings of our study also suggest that kinesiophobia in individuals with FAIS reduces participation in daily life activities and negatively impacts functional status.

Samaan et al.³⁴ stated that the 30-second Sit-to-Stand Test (30STS) is a valid measure for assessing lower extremity joint mechanics and functional performance in individuals with FAIS. The positive correlation found in our study between the 30STS test and the Harris Hip Score (HHS) indicates that improved hip joint function is associated with higher lower extremity performance in individuals with FAIS. It has been reported that during the sit-to-stand activity, individuals with FAIS exhibit compensatory concentric activation of the hip internal rotators and reduced activation of the gluteus medius muscle.³⁵ This suggests that muscle imbalances around the hip may reduce movement efficiency during functional tasks. The literature also indicates that symptomatic individuals with FAIS experience movement impairments during functional tasks such as sit-to-stand.³⁶ Therefore, the positive relationship identified in our study suggests that increased functional capacity in these individuals may contribute to performing daily activities more efficiently and with better balance.

Previous literature has demonstrated that the relationship between hip pain and pathological changes in joint morphology is weak.³⁷ There is consensus that FAIS should not be diagnosed solely on the basis of radiological findings in the absence of appropriate symptoms and clinical signs, as a substantial proportion of the general population presents with cam and/or pincer morphology.³⁸ The presence of cam deformity on radiographic assessment does not always lead to impingement, and these morphologies are frequently observed in healthy young adults as well.^{39,40} Therefore, the terms “radiological FAIS” or “asymptomatic FAIS” are used in the literature to describe structural hip morphology rather than a clinical disorder. This highlights the need to investigate the relationship between pain and hip morphology using more comprehensive biomechanical and clinical parameters.

In our study, the relationship between Visual Analog Scale (VAS) scores and joint range of motion was evaluated, and a moderate inverse relationship was observed between pain at rest and external rotation range of motion. This finding indicates that as the level of pain at rest increases, external rotation range of motion decreases. Literature examining range of motion in individuals with FAIS using three-dimensional motion analysis has reported that individuals with FAIS exhibit significantly less external rotation at 90° flexion compared to healthy controls.^{41,42} Furthermore, symptomatic individuals with FAIS have been shown to demonstrate significantly reduced external rotation compared to both healthy

controls and asymptomatic individuals.⁴³ These findings suggest that pain-related movement limitations in symptomatic individuals are particularly pronounced in external rotation, and that increasing this movement may provoke pain symptoms.

Jochimsen et al.³³ did not find a significant relationship between pain levels measured by the Visual Analog Scale (VAS) and kinesiophobia in individuals with FAIS. Similar findings were observed in our study. A possible explanation for this result is that some individuals with FAIS may be less inclined to avoid movement despite pain, due to factors such as education level or prior physical activity habits. Additionally, the VAS measures only the intensity of pain and may not fully capture its psychosocial dimensions, which could also explain the lack of association. This suggests that kinesiophobia in individuals with FAIS should be considered not only in relation to pain intensity but also in the context of pain perception, coping strategies, and psychosocial factors.

In our study, significant relationships were observed between VAS scores at rest and radiographic parameters. A low positive correlation was found between pain at rest and the alpha angle, whereas a moderate inverse correlation was observed with the lateral center-edge angle (LCEA). It is known that increases in the alpha angle are associated with labral degeneration and cam deformity^{44–46}; therefore, higher alpha angles are expected to correspond with increased pain levels. In adults, an alpha angle above 55° has been reported to be associated with hip pain.⁴⁵ Allen et al.⁴⁶ noted that alpha angles of 60° and above are more commonly associated with hip pain. The mean alpha angle of our participants being above the threshold values associated with pain in the literature supports this finding. Our results differ from those reported by Yamauchi et al.⁴⁷, which may be attributed to differences in participant characteristics and measurement methods.

The lateral center-edge angle (LCEA) is a parameter indicating the degree of acetabular coverage, and deviations above or below normal values may lead to different clinical outcomes.⁵ In our study, a moderate inverse relationship was observed between LCEA and pain at rest. This finding is consistent with literature reporting that coxa profunda (high LCEA) is associated with lower pain levels.⁴⁸ Therefore, an increase in LCEA may correspond to reduced pain during rest. However, since LCEA values in our sample were generally within normal limits, the generalizability of this relationship is limited.

No significant relationships were found between LCEA and alpha angle with range of motion (ROM) measurements in our study. Similarly, the literature indicates that symptomatic FAIS is not associated with reduced ROM, and surgical interventions do not lead to significant changes in ROM.^{47,49} Furthermore, asymptomatic individuals with FAIS morphology have been shown to have ROM values similar to healthy controls.⁵⁰ Naili et al.⁵¹ also noted that ROM limitations cannot be explained solely by morphological factors. Meta-analytic findings support the notion that individuals with FAIS reduce their movement depth due to pain or fear of movement.³¹ These findings are in agreement with our study. It can be suggested that ROM limitations in individuals with FAIS are influenced not only by bony morphology but also by pain, capsuloligamentous changes, and kinesiophobia.

In our study, no significant relationships were found between radiographic parameters (alpha angle, LCEA) and the Harris Hip Score or 30-second Sit-to-Stand (30STS) test. Similarly, Zhang et al.⁵² reported that hip scores and muscle strength in asymptomatic individuals with FAIS did not differ from those of healthy controls. These findings suggest that radiographic parameters do not directly influence hip function, and that the functional status of individuals with FAIS is more affected by factors such as limitations in range of motion, pain, and kinesiophobia. The literature indicates that maladaptive pain-related thoughts and emotions in individuals with chronic hip pain may lead to kinesiophobia, which in turn can result in increased pain and functional limitations.⁵³

These results suggest that fear of movement is more strongly influenced by pain perception and maladaptive beliefs rather than structural deformities. These findings also highlight the importance of addressing kinesiophobia and functional limitations in the management of FAIS, rather than relying solely on radiographic morphology for treatment decisions. Rehabilitation programs that include targeted strategies to reduce fear-avoidance behaviors, improve joint mobility, and enhance functional capacity may be beneficial. In addition, assessing psychosocial factors and patients' pain beliefs could help tailor individualized interventions, potentially improving adherence, reducing disability, and optimizing post-surgical or conservative outcomes.

4.1. Study limitations

Our study has several limitations. First, the small sample size may limit the generalizability of our findings. Another limitation is the variability in participants' physical activity levels, which could have influenced both functional performance and kinesiophobia levels. In addition, our cross-sectional design prevents establishing causal relationships between kinesiophobia, pain, functional status, and radiographic parameters. Additionally, radiographic measurements may not fully capture dynamic joint mechanics; more advanced imaging techniques, such as magnetic resonance imaging (MRI) or three-dimensional motion analysis, could provide further insights. Future studies with larger, more homogeneous cohorts, longitudinal designs, and comprehensive psychosocial and biomechanical assessments are warranted to better elucidate the role of kinesiophobia in individuals with FAIS.

5. CONCLUSION

Kinesiophobia was significantly associated with hip rotation range of motion and functional status, whereas radiographic measures showed no meaningful clinical relevance. These findings emphasize the need to include psychosocial factors—particularly fear of movement—in the clinical evaluation and rehabilitation of individuals with FAIS, as addressing kinesiophobia may contribute to improved mobility and functional outcomes.

Declarations

Ethics approval

The study was ethically reviewed and approved by the “Istanbul Medipol University Institution Non-Interventional Ethics Committee” on the date of 25.12.2023 with the file number E-10840098-772.02-7986.

Ethical approval was obtained from the Istanbul Medipol University Non-Interventional Ethics Committee on 25 December 2023 (Approval No: E-10840098-772.02-7986). Written informed consent was obtained from all participants.

Author Contributions:

G.A.B. and Y.I. contributed to conceptualization of the study. Y.I. collected the data and wrote the original draft of the manuscript. G.A.B. contributed to writing – review & editing. S.G. contributed to conceptualization and provided supervision. All authors read and approved the final version of the manuscript.

Conflicts of interest

None to declare.

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Declaration of conflicting interest

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Data availability

The datasets generated during the current study are not publicly available because of ethical approval limitations, but may be obtained from the corresponding author on reasonable request.

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