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FACTORS AFFECTING FUNCTIONAL STATUS IN INDIVIDUALS WITH KNEE OSTEOARTHRITIS AND LUMBAR DEGENERATIVE DISEASE

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ABSTRACT

Objective: This study aimed to investigate the interaction between functional impairment due to lumbar degenerative disease and knee osteoarthritis (KOA) in individuals presenting with concurrent low back and knee pain. We evaluated the relationship between the knee injury and osteoarthritis outcome score (KOOS) and the Oswestry disability index (ODI).

Materials and Methods: This study retrospectively analyzed 114 patients experiencing both chronic low back and knee pain. Functional status was assessed using KOOS and ODI scores obtained from hospital records. Radiographic evaluations included sagittal vertical axis, thoracic kyphosis, lumbar lordosis, spinopelvic parameters, spinal canal measurements, and Kellgren-Lawrence (K-L) grading for KOA severity. Spearman correlation and multivariate logistic regression were used to analyze associations.

Results: The mean age was 62.5±10.1 years, and 86% of the patients were female. KOOS and ODI scores showed a moderate negative correlation (r=-0.61). KOOS was identified as an independent predictor of disability (β=-0.0614, p<0.001). No significant relationship was found between ODI and age, body mass index, or K-L grade. Among spinopelvic parameters, sacral slope (SS) showed a significant negative correlation with ODI (r=-0.23, p<0.05). Additionally, the presence of scoliosis was associated with higher ODI scores (p<0.05), while spondylolisthesis was associated with lower KOOS scores (p<0.05).

Conclusion: KOOS scores are significantly associated with back-related disability in individuals with coexisting KOA and lumbar spine degeneration. Structural variations such as SS and scoliosis may also influence functional outcomes. Lower KOOS may indicate greater disability in patients with concurrent knee and back pain, emphasizing the need to prioritize knee-related symptoms in management.

Keywords: Knee osteoarthritis, lumbar degenerative disease, functional status, KOOS, ODI

INTRODUCTION

Knee osteoarthritis (KOA) and lumbar spine degeneration (LSD) are two important musculoskeletal pathologies that are frequently encountered in elderly individuals and significantly reduce the quality of life[1,2]. Both diseases are accompanied by pain, limitation of movement, functional and sensory loss and often occur simultaneously[3-5]. Chronic low back pain (LBP) is common in patients with KOA, and this phenomenon has even been defined as "knee-spine syndrome"[6].

The majority of studies on KOA and LSD have focused on the effects of the alignment of the lumbar spine and pelvic morphologies, and have confirmed a correlation between changes in the sagittal position of the spine and KOA[7,8]. In the literature, single-dimensional evaluations focused on the knee or waist are generally prominent, and comprehensive studies measuring the functional status of patients in a way that covers both regions are on the agenda[9,10].

This study examined the relationship between knee function, as assessed by the knee injury and osteoarthritis outcome score (KOOS), and back disability, as measured by the Oswestry disability index (ODI). This is the first study to jointly evaluate the relationship between spinopelvic parameters and KOOS scores, which reflect knee function, and ODI in individuals with KOA and LBP. This holistic approach is rare in the literature, as it reveals the impact of KOOS not only on knee function but also on overall quality of life. We aimed to determine whether these two important joint regions interact with each

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other at a functional level in individuals with concurrent knee and back diseases, and to emphasize the necessity of a holistic perspective in clinical management.

MATERIALS AND METHODS

Ethical approval for this study was obtained from the University of Health Sciences Türkiye, Gülhane Training and Research Hospital's Ethics Committee (approval no: 2024-511, date: 05.11.2024). This retrospective cross-sectional study involved patients who attended the Orthopedics and Traumatology Outpatient Clinic of University of Health Sciences Türkiye, Gülhane Training and Research Hospital due to chronic low back and knee pain. Following clinical evaluations, patients' functional statuses were assessed using the ODI and the KOOS, both of which had previously been administered as part of routine outpatient care and were available in the hospital records.

Radiological data were obtained from the institutional picture archiving and communication system and the national e-Nabız health database. Only patients with adequate imaging, including previously acquired anteroposterior and lateral radiographs of the lumbar and thoracic spine, pelvic X-rays, and lumbar magnetic resonance imaging scans were included in the study. Patients without sufficient radiological data were excluded. All patients completed the KOOS and ODI forms during their outpatient clinic examination, on the same day, simultaneously with the radiological evaluation. Incomplete forms were excluded from the study.

All radiological measurements were performed by a single trained physician (U.Y.) to maintain measurement consistency. Spine alignment parameters such as sagittal vertical axis (SVA), thoracic kyphosis, lumbar lordosis, pelvic tilt (PT), pelvic incidence (PI), and sacral slope (SS) were measured. In addition, sagittal spinal canal diameters (L1-S1 levels) and canal cross-sectional areas were recorded. The Kellgren-Lawrence (K-L) scale was applied to assess the severity of KOA. Structural abnormalities such as scoliosis and spondylolisthesis were also noted.

The relationships between clinical scores and radiological findings were examined using comparative and correlational statistical analyses. Patients younger than 18 or older than 80 years, those with a history of spinal or knee surgery, individuals with neuromuscular disorders, and those with a diagnosis of malignancy were excluded from the study.

Two validated and reliable instruments were used to assess functional status: the KOOS and the ODI. The KOOS is a comprehensive tool that evaluates symptoms and functional limitations related to the knee joint, with scores ranging from 0 to 100. KOOS includes five subcomponents: symptoms, pain, daily activity, sports/recreation, and quality of life. The total KOOS score in this study was derived by averaging these components, with higher scores representing improved knee performance and reduced symptoms[11].

The ODI is a widely used questionnaire developed to assess functional disability associated with LBP pain. Scoring on the ODI ranges from 0 to 100, with higher scores reflecting increased functional limitation. This index is widely used to assess the impact of LBP on everyday functioning[12].

Statistical Analysis

Data analysis was conducted using IBM SPSS Statistics (v22.0, IBM Corp., Armonk, NY, USA). Results for continuous variables were expressed as mean ± standard deviation, whereas categorical variables were described using frequency and percentage distributions. The distribution characteristics of the data were assessed using the Shapiro-Wilk test.

To further explore factors influencing ODI scores, a multivariable logistic regression analysis was performed by categorizing patients based on the ODI median value: ⩽39 (indicating good function) and >39 (indicating poor function). KOOS total and subscale scores, as well as other demographic and radiological variables, were included in regression models. Model fit and multicollinearity were evaluated.

The extent of KOA was evaluated based on the K-L grading criteria and grouped into low severity (grades 0-2) and high severity (grades 3-4).

Between-group comparisons were conducted using the Mann-Whitney U test for non-parametric data and the independent samples t-test for parametric data. Relationships between two continuous variables were evaluated using Spearman's rank correlation analysis.

To identify factors associated with ODI scores, a multivariable logistic regression analysis was performed. Additionally, alternative models were constructed to assess the impact of KOOS total and subscale scores on functional outcomes. Model fitness and multicollinearity diagnostics were considered, and simplified models were used for reanalysis when appropriate. A p-value of <0.05 was considered statistically significant for all analyses.

RESULTS

A total of 114 patients were included in the study. The mean age of the participants was 62.5±10.1 years, and the mean body mass index (BMI) was 28.3±5.1 kg/m^2. 86% of the participants were female (n=98), 14% were male (n=16). The mean ODI score was 35.3±18.8, and the KOOS score was 48.7±20.9 (Table 1).

According to Spearman's correlation analysis, a negative, moderate correlation was found between KOOS and ODI scores (r=-0.61). Logistic regression analysis revealed that the KOOS score was an independent predictor of functional impairment in individuals with an ODI greater than 39 (β=-0.06, p<0.001) (Figure 1). Other variables (age, BMI, K-L score) were not found to be significant (Table 2).

According to the K-L score, the patients were divided into two groups: Group 1 (K-L 0-2) and Group 2 (K-L 3-4). The mean ODI was 39.99 in Group 1 and 38.08 in Group 2. According

to the Mann-Whitney U test result, this difference was not statistically significant (p=0.5069) (Figure 2).

The effects of spinal alignment parameters such as SVA, thoracic kyphosis, lumbar lordosis, and on ODI were investigated. There was a slight positive association observed between lumbar lordosis and ODI scores (r=0.07), while slight negative correlations were found with thoracic kyphosis (r=-0.09) and SVA (r=-0.10). None of these correlations were found to be statistically significant.

Table 1. Demographic and clinical characteristics

	Mean ± SD or n (%)
Age (years)	62.5±10.1
Sex (F/M)	98/16 (86/14%)
BMI (kg/m^2)	28.3±5.1
ODI	35.3±18.8
KOOS	48.7±20.9
Lumbar lordosis (°)	47.5±12.3
Thoracic kyphosis (°)	40.1±10.5
Sagittal spinal canal diameters (mm)	
L1-2 anterior-posterior diameter	12.43±1.55
L2-3 anterior-posterior diameter	11.43±1.81
L3-4 anterior-posterior diameter	10.76±2.38
L4-5 anterior-posterior diameter	10.30±1.89
L5-S1 anterior-posterior diameter	11.55±1.54
Spinal canal area (cm^2)	
L1-2 area	1.34±0.34
L2-3 area	1.14±0.32
L3-4 area	0.99±0.29
L4-5 area	0.90±0.34
L5-S1 area	1.03±0.27
Spinopelvic parameters (°)	
PI	53.89±10.63
PT	16.77±7.90
SS	36.52±10.98
Structural findings	
Scoliosis (present)	29 (25.4%)
Spondylolisthesis (present)	27 (23.7%)

SD: Standard deviation, BMI: Body mass index, ODI: Oswestry disability index, KOOS: Knee injury and osteoarthritis outcome score, PI: Pelvic incidence, PT: Pelvic tilt, SS: Sacral slope

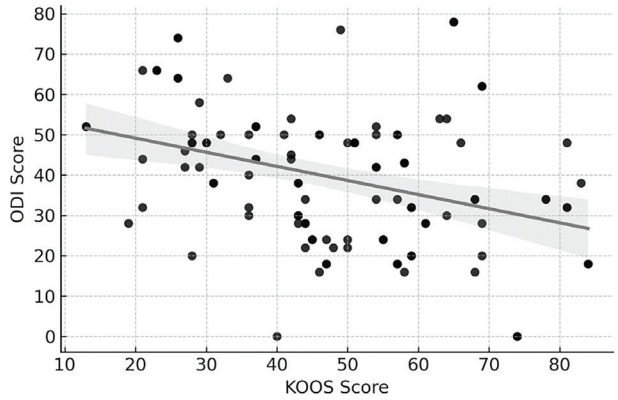

Figure 1. Correlation graph between KOOS and ODI scores. A negative correlation is observed between KOOS and ODI scores. As KOOS increases (knee function improves), ODI decreases (back function improves). KOOS: Knee injury and osteoarthritis outcome score, ODI: Oswestry disability index

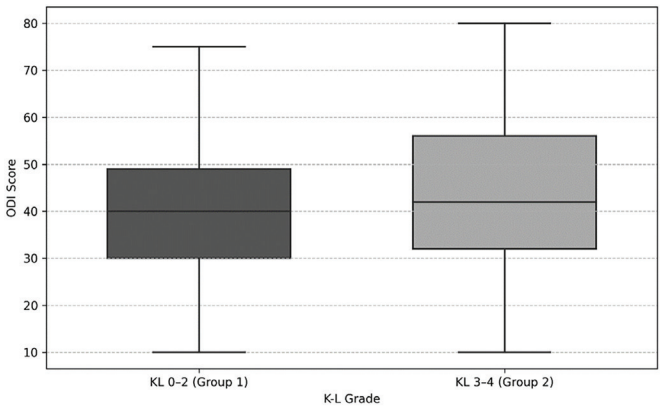

Figure 2. Comparison of ODI scores between patients with low (K-L grade 0-2, Group 1) and high (K-L grade 3-4, Group 2) radiographic knee osteoarthritis severity. ODI: Oswestry disability index, K-L: Kellgren-Lawrence

Table 2. Multivariate logistic regression analysis for predicting high disability (ODI >39)

	β coefficient	OR	95% CI (lower-upper)	p-value
KOOS total	-0.06	0.94	0.91-0.97	<0.001
KOOS symptoms	-0.02	0.98	0.95-1.01	0.12
KOOS pain	+0.01	1.01	0.97-1.05	0.71
KOOS daily activities	-0.02	0.98	0.94-1.02	0.29
KOOS sports	-0.02	0.98	0.96-1.00	0.09
KOOS quality of life	+0.01	1.01	0.98-1.04	0.68
Age	+0.03	1.03	0.98-1.09	0.22
BMI	-0.03	0.97	0.90-1.04	0.41
K-L score	-0.34	0.71	0.40-1.25	0.23

ODI: Oswestry disability index, OR: Odds ratio, CI: Confidence interval, KOOS: Knee injury and osteoarthritis outcome score, BMI: Body mass index, K-L: Kellgren-Lawrence

Sagittal L1-S1 levels were evaluated. No statistically significant correlation was found between these diameters and ODI or KOOS scores (all p>0.05). Cross-sectional spinal canal areas were also measured. A weak positive correlation was found between L5-S1 area and KOOS score (r=0.21, p<0.05), indicating that greater canal area may be associated with better knee function. Spinopelvic parameters were analyzed. Among them, SS showed a significant negative correlation with ODI (r=-0.23, p<0.05), suggesting that a lower SS is associated with higher disability. No significant correlations were found for PI or PT. Among the patients, 29 (25.4%) had scoliosis and 27 (23.7%) had spondylolisthesis. The presence of scoliosis was significantly associated with higher ODI scores (p<0.05), while spondylolisthesis was significantly associated with lower KOOS scores (p<0.05) (Table 3).

DISCUSSION

In this study, we aimed to investigate the interaction between lumbar degenerative disease and KOA in patients presenting with concurrent back and knee complaints. The KOOS score is a measure that evaluates symptoms and functional capacity of the knee joint; higher scores indicate better knee function. In our study, the negative correlation between KOOS score and ODI indicates that disability in the lumbar region decreases as knee function improves. This finding suggests that improving the functional status of the knee in clinical practice may provide not only a local benefit but also positive effects on general physical capacity.

Muraki et al.[13] emphasized the overlapping symptomatology between lumbar spine diseases and KOA, showing that lower extremity joint dysfunction may affect quality of life due to the involvement of the lumbar spine. Iijima et al.[14] conducted a study on 260 participants with KOA, showing that accompanying back pain in individuals with knee pain has significant negative effects on quality of life and functional capacity. Again, Kim et al.[15] in a nationwide survey conducted with a large sample of participants, knee pain and LBP are important factors affecting the quality of life in people over 50 years of age. Our study also supports this perspective and quantitatively demonstrates that ODI scores are higher in patients with more severe knee symptoms.

There is strong scientific evidence that physical function deteriorates and quality of life decreases with increasing radiographic severity (K-L score) in patients with KOA[16-18]. However, radiographic severity and quality of life or disability in KOA are not always correlated. While some patients may have minimal complaints despite severe radiographic findings of osteoarthritis, some patients may have severe symptoms despite minimal radiographic findings[19,20]. Our findings align with the systematic review by Bedson and Croft[20], which documented a considerable discrepancy between clinical symptoms and radiographic osteoarthritis. According to their review, only 15-76% of patients with knee pain had radiographic KOA, and similarly only 15-81% of those with radiographic KOA reported knee pain[20]. These results suggest that radiographic severity does not consistently correlate with patient-reported symptoms or disability, and that multiple factors-such as pain definitions, imaging protocols, and demographic characteristics-contribute to this discordance. According to Yasuda et al.[21], K-L grade progression was linked to increased ODI scores in females, while ODI remained relatively stable across K-L grades in males. In our study, when patients were divided into two groups according to the radiographic stage of KOA, no significant difference was found in terms of ODI scores

Table 3. Correlation between radiological parameters and functional scores

		ODI (r)	ODI (p-value)	KOOS (r)	KOOS (p-value)
Canal diameters (mm)	L1-2	-0.04	0.66	0.11	0.24
	L2-3	0.0	0.98	0.11	0.25
	L3-4	-0.1	0.27	0.07	0.45
	L4-5	0.07	0.45	0.12	0.19
	L5-S1	-0.02	0.85	0.1	0.29
Canal area (cm^2)	L1-2	0.08	0.37	0.17	0.06
	L2-3	0.05	0.59	-0.01	0.93
	L3-4	0.01	0.95	0.07	0.48
	L4-5	0.13	0.18	0.14	0.13
	L5-S1	-0.03	0.72	0.21	<0.05
Spinopelvic parameters (°)	PI	-0.06	0.54	-0.17	0.07
	PT	0.08	0.40	-0.02	0.84
	SS	-0.23	<0.05	-0.12	0.22
Structural conditions	Scoliosis		<0.05		
	Spondylolisthesis				<0.05

ODI: Oswestry disability index, KOOS: Knee injury and osteoarthritis outcome score, PI: Pelvic incidence, PT: Pelvic tilt, SS: Sacral slope

between the high-stage and low-stage KOA groups. This may be due to the simultaneous evaluation of patients with knee and LBP in our study. This finding suggests that the severity of structural degeneration in the knee does not always reflect the functional status of the low back.

Another noteworthy finding is that sagittal plane radiological parameters, such as SVA, thoracic kyphosis, and lumbar lordosis did not significantly influence the level of disability. This finding aligns with the results previously reported by Niu et al.[22], who, in their cross-sectional study involving 435 patients with non-specific chronic LBP, found that only the spino-sacral angle and age were significantly associated with disability. At the same time, other sagittal parameters failed to predict patient-reported functional outcomes such as the ODI. Interestingly, while Niu et al.[22] reported no significant correlation between SS and ODI, our study identified a significant negative correlation between SS and ODI. This finding suggests that sacral inclination may indeed influence functional status, highlighting the importance of evaluating individual differences in pelvic morphology more closely. Collectively, these observations emphasize that subjective functional scores, such as KOOS and ODI, may better reflect the real-life burden experienced by patients than structural imaging alone. Therefore, incorporating patient-reported outcome measures into the clinical assessment of degenerative spinal and knee disorders is essential for a more comprehensive evaluation. Another notable finding was that although the KOOS subscales were not statistically significant, the total KOOS score remained a significant predictor of disability. This suggests that cumulative burden across multiple domains-pain, symptoms, function, and quality of life-may influence resulting disability more than any single subdomain.

The study's retrospective design and modest sample size constitute notable limitations that may affect the robustness and generalizability of the conclusions. The fact that the number of female patients in our study was significantly higher than that of male patients raises the possibility that the results may be biased by gender. This imbalance should be evaluated carefully, considering the potential effects of gender on pain threshold, disability perception, and functional scores. The use of a single observer for radiological measurements may be considered a limitation, although the primary objective of the study was not to assess the reliability of these measures. Additionally, patients' previous medical treatment history was not included, which may have affected the KOOS and ODI scores.

CONCLUSION

This study demonstrated that lower KOOS scores were significantly associated with higher levels of back-related disability index. Lower SS values were linked to greater disability, while the presence of scoliosis was associated with increased ODI scores. In contrast, patients with spondylolisthesis had significantly lower KOOS scores, indicating reduced knee function. These findings underscore the importance of evaluating both lumbar spine and knee function simultaneously in cases of degenerative musculoskeletal disorders. We recommend that knee-related symptoms may contribute more to disability, especially in patients with low scores on KOOS subscales, and therefore, knee-focused treatment approaches should be prioritized.

Ethics

Ethics Committee Approval: This retrospective study was notified to our Local Ethics Committee and authorized by University of Health Sciences Türkiye, Gülhane Training and Research Hospital's authorities (approval no: 2024-511, date: 05.11.2024).

Informed Consent: This study retrospectively analyzed 114 patients experiencing both chronic low back and knee pain, the need for informed consent was waived.

Footnotes

Authorship Contributions

Surgical and Medical Practices: E.Y., Concept: H.Y.T., Design: U.Y., H.Y.T., Data Collection or Processing: A.A., Analysis or Interpretation: E.Y., Literature Search: A.A., Writing: U.Y.

Conflict of Interest: No conflict of interest was declared by the authors.

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