

Correlation between Pain Intensity and Functional Limitations in Early Knee Osteoarthritis – A Pilot Study

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Abstract

Background and purpose: Early knee Osteoarthritis (EKO), despite minor changes on X-ray, often presents with considerable pain and limitations of function. Pain is considered the primary factor influencing activity restriction, yet the link between severity of pain and measurable functional performance in EKO remains underexplored.

Method: This pilot study recruited 15 participants (aged 41–55 years) with radiographically confirmed EKO (Kellgren–Lawrence grade 1 and 2). The severity of pain was measured using the Numeric Pain Rating Scale (NPRS) and disability using the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC). Objective functional ability was examined using the Timed Up and Go (TUG), 30-second Chair Stand Test (CSTS), and Stair Climb Test (SC). Pearson correlation was used to examine pain-function association.

Result: Pain intensity showed a strong positive correlation with TUG ($r=0.903$, $p=0.000$) and SC ($r=0.791$, $p=0.000$), and a strong negative correlation with CSTS repetitions ($r=-0.925$, $p=0.000$), confirming that higher pain intensity is linked with greater functional limitation.

Conclusion: This pilot study shows pain intensity strongly predicts functional decline in EKO. It highlights reduced strength and mobility, underscoring the need for early pain management with strengthening interventions to preserve function and delay progression.

Keywords: Cross-Sectional Studies, Early OA, Knee Osteoarthritis, Mobility Limitations, Osteoarthritis, Pain Measurement

Introduction

Osteoarthritis is a long-term condition that gradually damages cartilage and surrounding joint structures [1]. It is the leading cause of pain, functional disability and reduced well-being among the elderly and middle-aged population worldwide. The knee joint is the most commonly affected due to its major role in weight-bearing, shock absorption, and mobility during activities of daily living [2]. EKO represents a critical phase in the disease continuum and is characterised by initial cartilage degeneration, mild joint space narrowing, episodic pain, and stiffness, which may gradually progress if not managed at the early stages [3].

In EKOA, pain emerges as the most significant symptom, often driving both reduced activity levels and limitations in participation. The severity of pain depends on joint loading, inflammation, muscle weakness and psychosocial factors. Notably, pain in EKOA is often activity-related and episodic; however, despite minimal structural degeneration, it can significantly impair functional performance by altering movement patterns and reducing muscle activation ^[4].

Assessment of functional limitations in EKOA typically combines patient-reported outcomes with objective performance measures to capture both perceived and actual capacity. However, reliance solely on subjective reports often fails to capture true functional capacity, particularly in the initial stages of OA ^[5].

Early detection of the pain-function relationship can help Physiotherapists develop targeted interventions that delay structural deterioration and improve overall functional independence. A thorough evaluation that combines subjective reports with objective testing is essential for accurate understanding ^[6, 7].

Objective assessments of mobility, strength, and endurance provide a clearer picture of real performance, yet remain underutilised in early OA research. Previous studies frequently combined patients across different disease stages, obscuring mechanisms unique to early OA in which pain is activity-related and limitations appear intermittently. Inclusion of participants with prior surgery or regular medication use further complicates findings, as these factors alter pain perception and biomechanics, masking genuine pain–function relationships. So, this study investigates only early-stage knee OA. By emphasising objective functional performance measures alongside clinical pain assessment, this study seeks to clarify whether pain intensity predicts actual functional impairment in EKOA.

This study addresses a key gap by clarifying the link between pain and function in EKOA. Using standardised outcome measures and carefully selected participants, it highlights how pain intensity predicts functional impairment. The findings support better clinical decision-making and guide physiotherapy strategies to preserve mobility and independence.

Methods

This pilot cross-sectional study recruited individuals aged 41–55 years with radiographically confirmed Grade 1 and 2 knee OA from a tertiary hospital Physiotherapy department between January and May 2026. Participants were included only if pain span was less than five months, they could walk independently, and could complete functional tests. Exclusions included advanced OA, prior surgery, inflammatory arthritis, recent injections, regular analgesic use, severe deformity, neurological or cardiopulmonary disorders, and BMI ≥ 35 . Before data collection, consent was obtained from every participant.

Baseline demographics, i.e. age, sex, Body Mass Index, occupation, affected side, and symptom duration, were documented. Musculoskeletal examination and radiographs confirmed diagnosis. Pain was measured using the NPRS; the WOMAC scale was used for examining disability status. Functional ability was examined using CSTS, SC, and TUG tests. All procedures were standardised, demonstrated beforehand, repeated thrice with rest intervals, and the best values recorded. Data analysis was performed using IBM SPSS Statistics. The pain–function correlations in EKOA were assessed using Karl Pearson’s correlation coefficient.

Result

Associations were tested with Pearson’s correlation, considering $p < 0.05$ significant. The study included 15 participants (mean age 51 ± 3.5 years), mostly females. OA severity was Grade 1 and Grade 2, with

most participants aged 51–55 years.

Table 1. Correlation Between Functional Disability (WOMAC) and Functional Performance Measures in EKO A Patients

		TUG (SEC)	CSTS (REP)	SC (SEC)
WOMAC	r value	0.932	-0.911	0.845
	p value	p<0.001*	p<0.001*	p<0.001*

Table 2. Pearson’s Correlation Between Pain Intensity (NPRS) and Functional Performance Measures in EKO A Patients

		TUG (SEC)	CSTS (REP)	SC (SEC)
NPRS	r value	0.903	-0.925	0.791
	p value	p<0.001*	p<0.001*	p<0.001*
	N	15	15	15

Discussion

Understanding the interplay between pain and function is crucial in EKO A, where radiographic changes are minimal, but disability begins to emerge. The results showed that the intensity of pain is closely linked with mobility decline, reflected in longer TUG ($r = 0.90$, $p < 0.001$) and Stair Climb time ($r = 0.791$, $p < 0.001$). The most pronounced effect was a negative correlation with muscular endurance, as evidenced by reduced CSTS repetitions ($r = -0.92$, $p < 0.001$).

These results are consistent with the study by Riapesi et al., which reported significant associations between radiological severity, pain intensity, and functional limitation in Indonesian patients with knee OA ($p = 0.0001$). Their findings emphasised that pain intensity was directly related to physical capability limitations, consistent with our observation that pain strongly impairs strength and endurance [8].

Similarly, Özden et al. confirmed that severity on X-ray of the knee was aligned with pain and poorer performance on the TUG test, reinforcing the link between structural degeneration, pain, and mobility decline. Our strong correlation between pain and TUG performance reflects this relationship [9].

Interestingly, Larsson et al. reported that functional capacity tests had limited value in detecting early radiographic OA in middle-aged subjects with persistent knee pain, as odds ratios were inconclusive and sensitivity/specificity were low. Their findings suggest that radiographic OA in the initial stages is not necessarily strongly linked to functional decline. On the other hand, our findings identified that even in early OA, pain intensity itself is already significantly associated with reduced muscular endurance. This affirms the validity of focusing on pain as a clinical marker of functional limitation, despite only mild changes on X-ray [10].

The combined findings of these studies propose that pain intensity is closely tied to functional limitation in knee OA. While Riapesi et al. and Özden et al. highlighted the role of radiographic severity in exacerbating pain and disability, our study offers a different perspective by focusing on early OA, in which pain already affects strength and mobility before advanced radiographic changes are present.

The strong correlation between pain and CSTS performance in our study underscores the usefulness of targeting muscular endurance in early intervention strategies. Clinically, this emphasises that managing

pain combined with strengthening exercises may be critical to preserving function and delaying progression in EKOA.

Limitations and Future Directions

The narrow sample size may have reduced the study's reliability. Larger longitudinal studies, stratified by OA grade, are recommended to clarify pain-function relationships.

Conclusion

This pilot research confirmed that pain severity has a strong relationship with self-reported disability (WOMAC) and functional performance measures (TUG, SC, CSTS). The most striking observation was the negative link between pain and muscular endurance, indicating that pain already compromises lower-limb strength in early OA.

These findings support the need to combine pain management with targeted strengthening programs to maintain function and slow disease progression. Although the sample size was small, the output indicates that pain may serve as an early indicator of functional decline in EKOA.

Abbreviations

OA – Osteoarthritis

SC – Stair Climbing

TUG – Timed Up and Go test

CSTS – 30-sec Chair Sit to Stand

NPRS – Numeric Pain Rating Scale

EKOA – Early Knee Osteoarthritis

WOMAC – Western Ontario and McMaster Universities Osteoarthritis Index

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