

Forgotten Joint Score-12 After Unicompartmental Knee Arthroplasty: Comparative Analysis of the Bulgarian Cohort with International Studies

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Abstract

The Forgotten Joint Score-12 (FJS-12) has emerged as one of the most sensitive patient-reported outcome measures currently available for evaluating postoperative joint awareness following knee arthroplasty. Unlike traditional instruments focused primarily on pain and functional limitation, the FJS-12 evaluates the extent to which patients remain consciously aware of their prosthetic joint during routine daily activities. This concept is particularly relevant in unicompartmental knee arthroplasty (UKA), where preservation of native ligamentous structures and physiological knee kinematics frequently leads to high postoperative functional outcomes and elevated patient expectations. The Bulgarian version of the FJS-12 was recently translated, culturally adapted, and validated in patients undergoing UKA. In the present study we compare postoperative joint awareness outcomes in the Bulgarian UKA cohort with those reported in previously published international UKA studies using the FJS-12 and discuss the clinical relevance of the FJS-12 in high-functioning UKA populations. Particular emphasis was placed on postoperative joint awareness, ceiling effects, and the role of the FJS-12 in assessing subjective prosthetic perception following UKA. We found that the Bulgarian FJS-12 demonstrates favorable psychometric performance and appears particularly suitable for evaluating postoperative joint awareness in UKA populations. Comparison with previously published UKA cohorts supports the clinical relevance and cross-cultural reproducibility of the instrument in high-functioning arthroplasty patients.

Keywords—Forgotten Joint Score-12, unicompartmental knee arthroplasty, postoperative joint awareness, patient-reported outcome measures, ceiling effect, unicompartmental knee arthroplasty.

1 Introduction

Knee osteoarthritis remains one of the leading causes of pain and disability worldwide, with increasing prevalence driven by population aging and rising obesity rates¹⁻¹⁰. As expectations regarding postoperative function and quality of life continue to evolve, modern arthroplasty outcome assessment increasingly relies on patient-reported outcome measures (PROMs) capable of capturing subtle differences in subjective recovery and patient satisfaction. PROMs have become an essential component of contemporary orthopaedic practice and are widely used to evaluate surgical outcomes, patient satisfaction, and health-related quality of life after knee arthroplasty^{11,12}. Traditional instruments such as the Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) and the Knee Injury and Osteoarthritis Outcome Score (KOOS) provide valuable information regarding pain, stiffness, and physical function. However, these instruments frequently demonstrate substantial ceiling effects in high-performing postoperative patients, particularly following UKA, thereby limiting their ability to discriminate between very good and excellent clinical outcomes¹²⁻¹⁵.

Introduced by Behrend et al.¹⁶ in 2012, the FJS-12 was specifically designed to address these limitations. Rather than focusing exclusively on pain or disability, the FJS-12 evaluates postoperative joint awareness — the extent to which patients consciously perceive their prosthetic joint during routine daily activities. The conceptual basis of the instrument is that the ultimate goal of successful joint arthroplasty is not merely pain reduction, but restoration of a joint that patients can effectively “forget” during everyday life¹⁶. This concept may be particularly important in UKA populations because preservation of cruciate ligament function and unaffected compartments allows many patients to maintain more physiological knee kinematics and a more natural perception of knee function after surgery^{2,11,17,18}. As a result, residual joint awareness rather than pain alone may become one of the most important determinants of patient satisfaction in high-functioning UKA populations.

Since its introduction, the FJS-12 has undergone translation and validation in multiple countries and languages, consistently demonstrating favorable psychometric properties and low ceiling effects^{13-15,20,21}. Adriani et al.¹³ highlighted the ability of the FJS-12 to discriminate between high-performing arthroplasty patients more effectively than conventional PROMs. Similarly, Sansone et al.²¹ demonstrated the usefulness of the instrument specifically in UKA populations, where subtle differences in postoperative joint awareness become increasingly clinically relevant. Interpretation of FJS-12 outcomes should nevertheless account for the substantial biomechanical and clinical differences between arthroplasty populations. Patients undergoing UKA preserve native ligamentous structures and unaffected compartments, whereas total knee arthroplasty involves broader biomechanical alteration and soft-tissue balancing procedures. Consequently, direct comparison between heterogeneous arthroplasty cohorts may not always be clinically appropriate^{17,18}.

The Bulgarian version of the FJS-12 was recently translated, culturally adapted, and validated in a cohort of patients undergoing UKA according to internationally accepted cross-cultural adaptation principles^{23,24}. The adaptation process additionally incorpo-

rated principles previously applied during validation of other adapted orthopedic instruments²⁵⁻²⁷. While the primary validation study established the fundamental linguistic and psychometric stability of the Bulgarian instrument, the present study expands this framework by evaluating the clinical phenomenon of joint awareness specifically against international UKA standards, addressing the critical need for distinct clinical interpretation in high-functioning populations. The aim of the present study was therefore to compare postoperative FJS-12 outcomes in the Bulgarian UKA cohort with those reported in previously published international UKA studies and to discuss the clinical relevance of joint awareness assessment following UKA.

2. Bulgarian version of the FJS-12

The Bulgarian version of the FJS-12 was recently translated, culturally adapted, and validated in a cohort of patients undergoing UKA²⁸. In brief, the Bulgarian cohort consisted of 89 patients who underwent primary UKA. All patients were evaluated at a minimum of 12 months postoperatively, with a mean follow-up of 6.2 ± 1.4 years. The cohort included 58% male and 42% female patients, with a mean age of 62 years (range 45–85) and a mean BMI of 27.4 kg/m^2 . Translation and cross-cultural adaptation of the Bulgarian FJS-12 followed internationally accepted forward–backward translation principles and established methodological guidelines^{23,24}.

The mean postoperative FJS-12 score in the Bulgarian UKA cohort was 79.5 ± 17.0 (median 85, IQR 77–90; range 4–100), indicating generally low postoperative joint awareness following UKA. Internal consistency remained high (Cronbach's $\alpha = 0.958$), while test–retest reproducibility was similarly substantial (ICC = 0.973). Item-deletion analysis demonstrated stable α values between 0.952 and 0.957, confirming that no individual questionnaire item disproportionately influenced the overall score. Only one patient (1.1%) achieved the maximum possible FJS-12 score, resulting in a ceiling effect of 1.1%, while no patient achieved the minimum possible score.

Construct validity was supported by significant negative correlations with WOMAC subscales, including pain ($\rho = -0.667$), stiffness ($\rho = -0.436$), function ($\rho = -0.619$), and total WOMAC score ($\rho = -0.703$), all $p < 0.001$. In the subgroup of 48 patients who completed the secondary assessment, significant positive correlations were additionally observed with KOOS Symptoms ($\rho = 0.741$, $p = 0.035$) and KOOS Quality of Life ($\rho = 0.817$, $p = 0.013$).

3. Comparison with International UKA Cohorts

Comparison with previously published UKA studies demonstrated that postoperative FJS-12 outcomes in the Bulgarian cohort remained fully comparable to internationally reported UKA populations despite differences in patient demographics and follow-up duration^{17,21,22}. Kyriakidis et al.¹⁷ reported excellent long-term clinical outcomes and implant survival in younger UKA patients, emphasizing the importance of patient satisfaction and subjective functional perception following surgery. Similarly, Sansone et al. demonstrated favorable psychometric performance of the Italian FJS-12

in UKA patients, supporting the suitability of the instrument for evaluating postoperative prosthesis awareness in high-functioning cohorts. Brilliant et al.²² further highlighted the clinical importance of postoperative joint awareness assessment in UKA populations, demonstrating lower joint awareness and higher functional outcomes in UKA patients compared with total knee arthroplasty cohorts at mid-term follow-up.

The Bulgarian UKA cohort demonstrated one of the lowest ceiling effects identified among currently published UKA studies, further supporting the ability of the FJS-12 to discriminate between very good and excellent postoperative outcomes in high-functioning patients^{12,13}. A comparison between the Bulgarian cohort and previously published international UKA studies is presented in Table 1.

Study	Country	UKA Patients (n)	Mean FJS-12 Score	Ceiling Effect	Main Findings
Luchev et al. ²⁸	Bulgaria	89	79.5 ± 17.0	1.1%	High reproducibility, strong construct validity, minimal ceiling effect
Sansone et al. ²¹	Italy	44	NR	<15%	Valid and reliable UKA-specific assessment of prosthesis awareness
Brilliant et al. ²²	USA	Matched UKA cohort	87 ± 20	NR	Lower postoperative joint awareness and superior function compared with TKA
Kyriakidis et al. ¹⁷	United Kingdom	96	NR	NR	Excellent long-term functional outcomes and implant survivorship in younger UKA patients

Table 1. Comparison of Bulgarian UKA FJS-12 Outcomes with International UKA Cohorts. (NR = Not Reported)

4. Discussion

The present analysis demonstrated that Bulgarian UKA patients achieved postoperative FJS-12 outcomes comparable to those reported in previously published international UKA cohorts^{17,22,23}. These findings further support the reproducibility of the Bulgarian adaptation while also providing additional clinical context regarding the role of postoperative joint awareness assessment in UKA populations. Although head-to-head, intra-institutional comparative trials provide a higher level of clinical evidence, cross-cultural benchmarking against published international literature serves as a critical and necessary first step to contextualize national outcomes within global orthopaedic stand-

ards. The FJS-12 appears particularly suitable for UKA patients because these individuals frequently achieve high postoperative functional outcomes while preserving more physiological knee kinematics than total knee arthroplasty populations^{17,18}. In such cohorts, residual joint awareness rather than pain alone may become an increasingly important determinant of patient satisfaction and subjective postoperative recovery. Traditional PROMs such as WOMAC and KOOS frequently demonstrate substantial ceiling effects in high-functioning UKA populations, thereby limiting their ability to discriminate between very good and excellent outcomes¹²⁻¹⁵. By specifically evaluating postoperative joint awareness, the FJS-12 may provide additional clinically relevant information regarding subjective recovery and patient perception of prosthetic integration following surgery^{13,16,21}.

Interpretation of comparative FJS-12 findings should nevertheless account for important biomechanical differences between arthroplasty populations. Unlike total knee arthroplasty cohorts, UKA patients preserve native cruciate ligament function, unaffected compartments, and larger portions of physiological knee mechanics^{11,17-18}. Consequently, the present study intentionally focused on comparison with previously published UKA cohorts rather than combining heterogeneous arthroplasty populations.

The observed construct validity patterns further support the clinical applicability of the Bulgarian FJS-12 in everyday arthroplasty practice. Significant correlations with WOMAC and KOOS subscales suggest that lower postoperative joint awareness is closely associated with improved subjective perception of knee function and quality of life. Taken together, the available evidence suggests that the FJS-12 may represent one of the most suitable PROM instruments currently available for evaluating high-functioning UKA populations. Its low ceiling effect and emphasis on postoperative joint awareness provide clinically meaningful information that may not be adequately captured by traditional PROMs alone^{12,13,16,21}. The Bulgarian adaptation additionally contributes to the growing availability of validated orthopaedic PROMs in Bulgarian clinical practice and may facilitate future multicenter outcome studies involving UKA populations.

5. Limitations

Several limitations should be acknowledged. First, the present study represents a comparative analysis based on previously collected validation data rather than a newly recruited prospective cohort. Additionally, comparing the Bulgarian cohort with historical international literature rather than a direct, concurrent national control group limits the ability to control for all confounding healthcare factors. Second, the KOOS subgroup included a relatively limited number of patients (n=48) due to administrative constraints and its later introduction into the follow-up protocol, which may introduce potential selection bias. Third, responsiveness to change was not assessed because of the cross-sectional design of the original validation cohort. Finally, the prolonged inclusion period (2015–2024) may have introduced variability associated with evolving surgical techniques, and the lack of chronological stratification or sub-analysis by specific implant design features remains a limitation of the current analysis.

6. Conclusion

The Bulgarian version of the FJS-12 demonstrates favorable psychometric performance and postoperative outcomes comparable to those reported in previously published international UKA cohorts. The instrument appears particularly suitable for evaluating postoperative joint awareness in high-functioning UKA patients because of its minimal ceiling effect and emphasis on subjective prosthetic perception. Comparison with other UKA-specific studies further supports the clinical relevance and cross-cultural reproducibility of the FJS-12 as a valuable outcome instrument in contemporary UKA practice.

7. References

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