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QUALITY OF LIFE IN PATIENTS AFTER ACL RECONSTRUCTION WITH CONCOMITANT MENISCAL INJURY

KVALITET ŽIVOTA NAKON ARTROSKOPSKE MENISCEKTOMIJE I REKONSTRUKCIJE PREDNJEG UKRŠTENOG LIGAMENTA KOLENA

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Abstract

Introduction. Anterior cruciate ligament injuries predominantly affect young, physically active, and working-age population. The objective of anterior cruciate ligament reconstruction extends beyond restoring knee stability and mechanical function; it also aims to improve the patient's overall quality of life. **Material and Methods.** A total of 307 patients diagnosed with anterior cruciate ligament injury were included in the study. This investigation builds upon our previous research, expanding the analysis to a larger patient cohort. Group A consisted of 187 patients with isolated anterior cruciate ligament rupture, while Group B included 120 patients with combined injuries: 70 with inner meniscus injuries, 24 with outer meniscus injuries, and 26 with injuries to both menisci. **Results and Discussion.** Analysis of the Knee Injury and Osteoarthritis Outcome Score revealed statistically significant differences across multiple parameters, including pain intensity, activities of daily living, sports and recreational function, and perceived quality of life. In all these domains, patients in Group A achieved better outcomes compared to those in Group B. Female patients demonstrated higher quality-of-life scores related to activities of daily living compared to male patients, which may be attributed to greater postoperative engagement in such activities. **Conclusion.** Although statistically significant differences were observed in several functional and quality-of-life domains, the overall findings did not demonstrate detectable clear advantage in quality of life for patients with isolated anterior cruciate ligament injuries compared to those with concomitant meniscal lesions following anterior cruciate ligament reconstruction.

Key words: Quality of Life; Anterior Cruciate Ligament Reconstruction; Meniscus; Wounds and Injuries; Knee

Sažetak

Uvod. Povrede prednjeg ukrštenog ligamenta najčešće pogađaju mlade, sportske i radno aktivne ljude. Cilj rekonstrukcije prednjeg ukrštenog ligamenta jeste ponovno uspostavljanje stabilnosti kolena i mehaničke funkcije; takođe cilj rekonstrukcije je i poboljšanje ukupnog kvaliteta života pacijenta. **Materijal i metode.** U istraživanje je ukupno uključeno 307 osoba sa dijagnozom povrede prednjeg ukrštenog ligamenta. Ono se nadovezuje na naše prethodne istraživačke napore, proširujući analizu na veću kohortu pacijenata. Grupa A se sastojala od 187 pacijenata koji su pretrpeli izolovanu rupturu prednjeg ukrštenog ligamenta, dok je B grupa obuhvatala 120 pacijenata: 70 sa povredama unutrašnjeg meniskusa, 24 sa povredama spoljašnjeg meniskusa i 26 koji su imali povrede oba meniskusa. **Rezultati i diskusija.** Analiza rezultata *Knee Injury and Osteoarthritis Outcome Score* upitnika za svaki parametar otkrila je relevantne razlike sa statističkom značajnošću u intenzitetu bola, svakodnevnim aktivnostima, učešću u sportu i percepciji kvaliteta života, gde je grupa A postigla bolje rezultate u poređenju sa grupom B. Žene su pokazale viši kvalitet života u odnosu na svakodnevne funkcionalne aktivnosti u poređenju sa muškarcima, verovatno zato što imaju tendenciju da više učestvuju u takvim aktivnostima nakon operacije. **Zaključak.** U našem istraživanju nismo identifikovali nikakvu uočljivu razliku koja bi ukazivala na to da osobe sa izolovanim rupturama prednjeg ukrštenog ligamenta imaju viši kvalitet života od onih koji imaju rupturu prednjeg ukrštenog ligamenta u kombinaciji sa lezijom meniskusa.

Ključne reči: kvalitet života; rekonstrukcija prednjeg ukrstenog ligamenta; meniskus; rane i povrede; koleno

Introduction

Injuries of the anterior cruciate ligament (ACL) predominantly affect young, physically active, and working-age individuals [1,2]. The reported annual incidence ranges from 30 to 78 cases per 100,000 individuals, while in high-risk populations – such as young athletes – the incidence may reach up to 85 cases per 100,000 in certain cohorts [3,4]. Previous studies have demonstrated considerably variability in the prevalence of concomitant injuries associated with ACL rupture, reporting 40-80% of patients with an ACL tear also sustain meniscal injury [5–7].

The primary objective of anterior cruciate ligament reconstruction (ACLR) extends beyond the restoration of knee stability and mechanical function; it also aims to improve patients' overall quality of life (QoL). In modern healthcare, patient-reported assessment of

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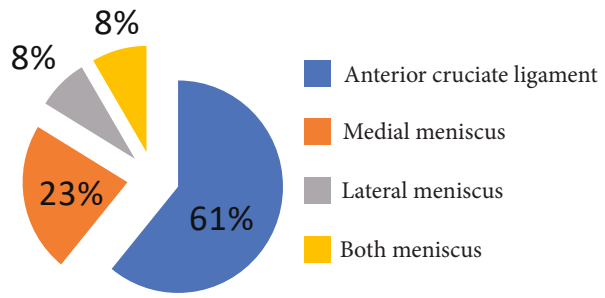
Abbreviations

ACL – anterior cruciate ligament
OA – osteoarthritis
PTOA – post-traumatic osteoarthritis
QoL – quality of life
WHO – World Health Organization
HRQoL – health-related quality of life
DLA – daily life activity
SD – standard deviation
AM – arithmetic mean
ACLR – anterior cruciate ligament rehabilitation
KOOS – Knee Injury and Osteoarthritis Outcome Score

health status are regarded as valid and essential indicators of well-being [8]. The World Health Organization (WHO) defines quality of life as an individual's subjective perception of their position in life within the context of the culture and value systems in which they live, and in relation to their goals, expectations, standards, and concerns [9]. Contemporary concepts of QoL increasingly emphasize subjective experience, moving away from exclusive reliance on objective or purely quantitative indicators. [10]. To assess QoL following arthroscopic ACLR, validated patient-reported outcome measures such as the ACL-QOL questionnaire and Knee Injury and Osteoarthritis Outcome Score (KOOS) are widely used [11].

The establishment of a clinical registry in 2012 at the Clinic for Orthopedic Surgery and Traumatology, University Clinical Center of Vojvodina in Novi Sad, enabled systematic investigation of postoperative outcomes and quality of life of patients with ACL injuries [12]. Through structured questionnaires, patients provide subjective evaluations of surgical outcomes and overall health status one year after ACLR [13]. The aim of the present study was to determine whether differences in quality of life exist between patients



Graph 1. Distribution of respondents based on concomitant injurie

with isolated ACL rupture and those with ACL rupture accompanied by concomitant meniscal injury – medial, lateral, or combined.

Material and Methods

This study was conducted at the Clinic for Orthopedic Surgery and Traumatology, University Clinical Center of Vojvodina, following approval from the institutional Ethics Committee. A total of 307 patients diagnosed with ACL rupture were included. The present investigation builds upon our previous research [14], expanding the analysis to a larger patient cohort. Participants were divided into two groups. Group A comprised 187 patients with isolated ACL rupture, while Group B included 120 patients with concomitant meniscal injury: 70 with inner meniscus injury, 24 with outer meniscus injury, and 26 with combined inner and outer meniscal injuries **(Graph 1).**

Statistical analysis revealed no significant differences between the groups regarding sex distribution, type of sport, level of sports activity, or limb laterali-

Table 1. Comparisons between groups based on various parameters

Parameters		Group A	Group B	Statistical significance
Gender	Male Female	145 42	97 23	p = 0.49 (>0.05) χ^2 = 0.46
Age	AM=26.3 min: 15 max: 55	AM =25.4	AM =27.6	p = 0.01 (<0.05)* t = 2.53
Type of sport activity	Professional Recreational Non-athletes	85 92 10	44 71 5	p = 0.11 (>0.05) χ^2 = 2.44
Level of sport activity	Recreational International Republican Regional Non-athletes	75 25 40 37 10	60 10 27 18 5	p = 0.07 (>0.05) t = -1.80
Laterality	Left Right Both	76 109 2	46 69 5	p = 0.83 (>0.05) χ^2=0.04
Time passed from injury to surgery	AM =10.2 months min: 1 month; max: 3 year	AM = 8.7 months	AM = 12.5 months	p = 0.001 (<0.05)* t=3.16

zation **(Table 1).** However, a statistically significant difference in age was observed, with patients in Group B being older on average than those in Group A (27.6 vs. 25.4 years). Additionally, the interval between injury and surgical intervention differed significantly, with patients in Group A undergoing ACLR earlier than those in Group B (8.7 months vs. 12.5 months, respectively).

Data collection was based on the KOOS questionnaire [15], supplemented with additional investigator-designed questions intended to obtain more detailed and comprehensive clinical information. These supplementary questions did not influence the final KOOS scoring or outcome interpretation [16]. The questionnaire consisted of five sections: (1) symptoms experienced by the patient; (2) pain during various physical activities; (3) activities of daily living (ADL); (4) physical activity level assessed in conjunction with the Lysholm Knee Scoring Scale; and (5) patient perception of overall quality of life and subjective understanding of the injury.

Prior to surgery, all participants completed a baseline questionnaire addressing injury characteristics and subjective symptoms. One year after ACLR, follow-up data were collected via email and/or telephone interviews, following prior patient notification and informed consent. All responses were anonymized and used exclusively for scientific analysis. Exclusion criteria included refusal to participate or continue participation, as well as failure to respond to email or telephone contact attempts.

Within the KOOS framework, scores range from 0 (extreme symptoms) to 100 (no symptoms). Due to the inclusion of supplementary questions, the scoring procedure deviated slightly from the standard KOOS protocol [12]; however, the resulting scores remained equivalent to those generated by the original scoring methodology.

The Lysholm Knee Scoring Scale is a validated patient-reported outcome measure used to assess knee-related symptoms and functional limitations [17]. It consists of eight items, yielding a total score ranging from 0 to 100, with higher scores indicating better knee function. The evaluated domains include limping (5 points), need for walking support (5 points), locking (15 points), instability or giving way (25 points), pain (25 points), swelling (10 points), stair climbing (10 points), and squatting ability (5 points) [17].

Descriptive statistical analyses included calculation of arithmetic mean (AM), standard deviation (SD), and minimum and maximum values for parametric variables. Frequencies were used to describe categorical variables. Comparative analysis between groups was performed using Student's t-test for parametric data and Pearson's χ^2 test for non-parametric variables.

Results

The mean preoperative Lysholm score was 76.26 in Group A and 69.69 in Group B. Postoperatively, Lysholm scores increased to 89.4 in Group A and 87.9 in Group B. No statistically significant differences were observed between the two groups in postoperative Lysholm scores. However, a significant difference was identified preoperatively, with Group A demonstrating markedly higher values Lysholm scores than Group B. In addition, both groups exhibited statistically significant improvements when comparing preoperative and postoperative values, with postoperative scores being substantially higher in each group **(Table 2).**

Analysis of the KOOS questionnaire results by individual subscales **(Table 3)** revealed statistically sig-

Table 2. Differences in Lyshol score between and within groups A and B

Lysholm score	t-test	p
Differences between groups in postoperative Lysholm score	-1.93	0.054 (>0.05)
Differences between groups in preoperative Lysholm score	-3.32	0.001 (<0.05)*
Differences within group A preoperative/postoperative	-10.58	0.000 (<0.05)*
Differences within group B preoperative/postoperative	10.41	0.000 (<0.05)*

Table 3. Assessment of quality of life based on the KOOS questionnaire

	Questionnaire in total (43 items)	Questionnaire scale				
		Subjective symptoms (6 items)	Pain intensity (6 items)	Daily life activities (DLA) (11 items)	Sport activities (14 items)	QoL awareness (6 items)
AM	107.25	16.40	10.38	19.45	45.82	15.18
SD	17.51	3.08	1.60	3.22	12.09	3.69
min	0	0	0	0	0	0
max	146	22	12	22	69	21

Table 4. Significance of differences on KOOS questionnaire scales according to injury type and gender

		Subjective symptoms	Pain intensity	Daily life activities (DLA)	Sport activities	QoL awareness
Injuries (LCA/LCA+ meniscal lesion)	t-test	-1.82	-2.23	-1.99	-2.04	-2.88
	p	0.06 (>0.05)	0.02 (<0.05) *	0.04 (<0.05)*	0.01 (<0.05) *	0.004 (<0.05) *
Gender (male/female)	t-test	-1.45	0.79	-1.21	-1.38	-2.09
	p	0.15 (>0.05)	0.43 (>0.05)	0.22 (>0.05)	0.17 (>0.05)	0.03 (<0.05) *

Table 5. Descriptive data on the significance of differences on KOOS questionnaire scales based on injury type and gender

	AM				SD			
	Injury		Gender		Injury		Gender	
	LCA	LCA+ meniscal lesion	M	F	LCA	LCA+ meniscal lesion	M	F
Subjective symptoms	16.64	15.99	16.26	16.88	2.98	3.17	3.04	3.15
Pain intensity	10.55	10.2	10.42	10.24	1.5	1.72	1.63	1.46
Daily life activities (DLA)	19.74	19.0	19.33	19.87	3.10	3.36	3.31	2.82
Sport activities	47.14	43.77	45.33	47.66	10.91	13.49	12.28	11.25
QoL awareness	15.66	14.43	14.95	16.03	3.38	4.02	3.70	3.52

nificant differences between the groups in pain severity, activities of daily living, sports and recreation, and subjective perception of quality of life **(Table 4).** In all these domains, Group A achieved significantly higher scores than Group B **(Table 5).** Furthermore, gender-based analysis demonstrated significant differences in quality of life perception, with female participants reporting higher levels of awareness compared with male participants **(Tables 4 and 5)**.

Discussion

Over the past five years, both the annual incidence of registered ACL injuries and the number of ACLR procedures performed have approximately doubled. The primary objectives of ACLR includes restoring knee stability, improving quality of life, preserving range of motion, and preventing progressive cartilage and meniscal degeneration, as well as reducing the risk of subsequent knee injuries. Facilitating patients' reintegration into everyday social life, returning to occupational duties, and resumption of athletic activity at pre-injury levels is particularly important given that ACLR is predominantly performed in younger individuals. From this perspective, systematic evaluation of postoperative outcomes is fully justified not only clinically but also socially [18,19].

Overall, postoperative quality of life following ACLR does not appear to be strongly correlated with patient age; however, specific questionnaire domains reveal meaningful differences. Women demonstrated higher quality of life related to activities of daily living than men, possibly reflecting greater engagement in such activities during the postoperative period. Patients in their forties appeared to cope better with postoperative symptoms than younger individuals, while men generally reported greater tolerance to postoperative pain than women. Younger patients, particularly those under 25 years of age, expressed greater satisfaction with sports participation compared with older cohorts [20].

It has been estimated that between 50% and nearly 100% of women sustaining an ACL injury will develop clinically significant pain, functional limitations, and radiographic evidence of knee osteoarthritis (OA) within 12-20 years [21,22]. The reported prevalence of concomitant meniscal injury in in ACL tears ranges from approximately 22% to 86% [23]. For decades, arthroscopic meniscectomy has been considered the standard treatment for meniscal lesions [23]. Although arthroscopic techniques provide advantages such as minimal invasiveness, faster recovery, and low complication rates, partial meniscectomy is nonetheless associated with an increased long-term risk of OA development [24]. Regardless of surgical technique, more than 50% of patients with ACL rupture exhibit clinical signs of knee OA within 15 years following surgery [25]. When ACL rupture is accompanied by meniscal injury, the likelihood of degenerative knee changes is even higher compared with isolated ACL tears [26].

Phillips et al. [27] reported that 10,001 participants (65%) had isolated ACL rupture, 2,895 individuals (18.8%) had concomitant medial meniscus injury, and 2,496 patients (16.2%) had lateral meniscus injury. Mortazavi et al. [28], in a longitudinal study of 111 patients with a mean follow-up of 23 months, found that the interval between injury and surgery was

longest in patients with medial meniscus damage (17.4 ± 16.8 months), followed by lateral meniscus injury (9.3 ± 8.3 months), and shortest in isolated ACL rupture (7.4 ± 8.1 months). A similar pattern was observed in our study, with considerably shorter time to surgery in patients with isolated ACL tears (8.7 months) compared with those with additional intra-articular injuries (12.5 months).

Functional outcomes in the present study were assessed using the Lysholm scoring scale [29]. Preoperatively, Group A demonstrated higher scores than Group B (76.26 vs. 69.69). Postoperatively, both groups showed marked improvement, with scores increasing to 89.4 and 87.9, respectively. While postoperative scores did not differ significantly between groups both, the postoperative disparity suggests greater functional impairment in patients with concomitant meniscal injury. These findings are consistent with those of Shoemaker et al. [30] who evaluated 1,228 patients with ACL injuries, including those with concomitant meniscal lesions, and analyzed changes in Lysholm scores before and after surgical treatment. In their cohort, patients with isolated ACL injuries had a mean preoperative Lysholm score of 61.0, which improved to 92.1 postoperatively. In contrast, patients with combined ACL and meniscal injuries demonstrated lower preoperative scores (mean 52.3), which increases to 90.1 following surgery.

Surgical reconstruction remains the preferred treatment for ACL rupture, particularly in young, physically active individuals and competitive athletes [1]. Consequently, optimal preoperative planning, precise surgical technique, and structured postoperative rehabilitation are essential for successful outcomes [31]. Approximately 83% of competitive athletes and 80% of recreational athletes return to sports following ACLR, although rates vary by sport [32–35]. Registry-based studies consistently demonstrate that ACLR results in improved quality of life, higher activity levels, and reduced subjective instability compared with conservative, non-operative management [33]. Psychological factors play a crucial role in postoperative recovery. Fear of reinjury, mental readiness, and self-confidence significantly influence return-to-sport outcomes [34]. Despite advances in surgical and rehabilitation strategies, the risk of secondary ACL rupture remains substantial, with reported rates ranging from 2% to 15% [16,18]. These injuries pose a considerable burden to patients and healthcare systems, contributing to long-term clinical and socioeconomic challenges.

Quality of life assessment – encompasses both subjective self-evaluation and objective external assessment. Numerous instruments have been developed to quantify health-related quality of life (HRQoL) [35,36]. Currently, HRQoL is recognized as central outcome measure in clinical practice and medical decision-making, serving as an important benchmark for patient outcomes and overall well-being [37]. Evaluating HRQoL and fear-avoidance beliefs in both uninjured athletes and those following ACLR provides valuable insight into targeted interventions [15].

The KOOS questionnaire was specifically designed to evaluate knee injuries with potential progression to post-traumatic osteoarthritis (PTOA) [16]. In our study, statistically significant differences were observed across all KOOS subscales except the QoL domain, with Group A achieving higher scores in pain, daily activities, and sports/recreation. Gender-based differences were also evident, with female patients demonstrating higher awareness and perception of quality of life. Similarly, Ulstein et al. [38] analyzed outcomes in 8,408 patients – 4,774 with ACL tears and 3,634 with concomitant meniscal injuries – and reported comparable mean KOOS scores between two groups across all subscales at a 5-year follow-up. Notably, patients with associated meniscal lesions exhibited greater improvement from baseline to the 5-year assessment in the pain, activities of daily living, and sports/recreation subscales. Cristiani et al. [39] evaluated KOOS outcomes in 5,378 patients and likewise reported no significant postoperative differences between patients with isolated ACL tears and those with concomitant meniscal injuries at either the 1-year or 2-year follow-up. However, significant preoperative differences were observed in the pain, daily activities, and sports/recreation subscales, with the lowest scores recorded in patients with lateral meniscus involvement. In contrast, Barenius et al. [40], in an 8-year prospective study of 164 patients, found that individuals with isolated ACL tears consistently achieved superior outcomes across all five KOOS subscales compared with those who sustained combined ACL and meniscal injuries.

The prevalence of PTOA after ACL injury has been reported to reach up to 87% [41]. Systematic reviews confirm a higher OA risk in patients with combined ACL and meniscal injuries, particularly with follow-up durations exceeding 10 years [15,38]. Once advanced OA develops, degenerative changes are largely irreversible, often leaving total knee arthroplasty as the only therapeutic option [41]. Severe OA is associated with pronounced reductions in HRQoL, emphasizing the substantial clinical burden of these injuries [42].

Although our 1-year follow-up did not demonstrate significant differences in overall QoL between groups, this does not preclude later deterioration.

Evidence indicates that at 5 years or more post-injury, radiographic OA changes are more prevalent in combined ACL-meniscus injuries and strongly associated with poorer QoL outcomes [34]. Advances in meniscal repair techniques may help reduce OA incidence in the future [43].

Several limitations should be acknowledged. First, reliance on subjective patient-reported outcomes may introduce reporting bias. Second, the relatively short follow-up period limits detection of early degenerative changes that may influence long-term quality of life. Clinical and self-reported assessments often show limited correlation, further emphasizing this limitation [20].

Overall, no significant association was identified between quality of life and age group when comparing younger and older patients following ACLR. Nevertheless, differences were observed in specific questionnaire domains across age categories. Postoperative knee instability was infrequent, occurring in 3.5% of all cases, and was more prevalent among male patients. This complication was observed predominantly in the youngest age group (under 25 years) and was not detected in patients aged 50 years or older.

Conclusion

In the present study, no detectable difference in overall quality of life was found between patients with isolated anterior cruciate ligament tears (Group A) and those with concomitant meniscal injuries (Group B). However, a clear and consistent disparity was observed in Lysholm score outcomes, with Group A demonstrating superior functional results both before and after reconstruction. These findings suggest that the presence of meniscal injury may adversely affect knee function in patients undergoing anterior cruciate ligament reconstruction. Future studies incorporating extending follow-up periods of 5, 10, or more years are warranted to provide a more comprehensive understanding of long-term impact of isolated versus combined anterior cruciate ligament and meniscal injuries on quality of life. Prolonged observation will also facilitate earlier detection of degenerative joint changes, including the development of osteoarthritis. Such long-term data are essential for determining whether combined injuries accelerate joint degeneration and for clarifying how progressive structural deterioration translates into functional impairment and patient-reported quality-of-life outcomes.

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