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ORIGINAL ARTICLE

Factors influencing return to sports after anterior cruciate ligament reconstruction

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ABSTRACT

Objectives: To assess the frequency of return to sports (RTS) after anterior cruciate ligament reconstruction (ACLR) and to identify factors influencing RTS in individuals from Karachi, Pakistan.

Methods: This retrospective cohort study included 109 participants who underwent ACLR between January 2016 and June 2021 at Liaquat National Hospital, Karachi, Pakistan. Patients aged 15–35 years with a pre-injury Tegner Activity Scale score of ≥6, a minimum of 12 months post-surgery, and completed rehabilitation were included. Patients with multi-ligamentous injuries or ACL re-ruptures were excluded. Participants were assessed using the Lysholm/Tegner score, the International Knee Documentation Committee (IKDC) subjective knee evaluation form, and the Tampa Scale for Kinesiophobia (TSK-11) to evaluate pre- and post-injury activity levels, knee function, and kinesiophobia, respectively.

Results: Among the 109 participants, 54.1% (n=59) returned to sports at a mean of 9.94±4.73 months post-ACLR; however, only 16.9% (n=10/59) of those who returned were able to achieve pre-injury performance levels. A significant proportion (45.9%, n=50/109) did not return to any level of sports. Those who returned demonstrated significantly higher IKDC (73.76 vs. 67.04, $p<0.05$) and Lysholm scores (95.45 vs. 85.82, $p<0.05$), and lower TSK-11 scores (37.44 vs. 44, $p<0.05$), indicating better knee function and lower kinesiophobia compared to non-RTS individuals.

Conclusion: Despite favorable functional outcomes post-ACLR, only half of the participants returned to sports, with an even lower proportion achieving pre-injury performance levels. Elevated kinesiophobia was significantly associated with reduced knee function and activity levels, emphasizing the need to address psychosocial factors in rehabilitation to improve RTS outcomes.

Keywords: Anterior Cruciate Ligament Reconstruction (MeSH); Anterior Cruciate Ligament Injuries (MeSH); Return to Sport (MeSH); Resumption of Sporting Activity (MeSH); Sports Medicine (MeSH); Kinesiophobia (MeSH); Wounds and Injuries (MeSH); Sports (MeSH); Motor Activity (MeSH).

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INTRODUCTION

An anterior cruciate ligament (ACL) injury is a frequent occurrence among both professional and recreational athletes, particularly those engaged in landing and pivoting sports.[1] Most sports injury experts consider anterior cruciate ligament reconstruction (ACLR) to be the clinical gold standard for restoring mechanical joint stability.[2] Although ACL tears can be managed either surgically or non-surgically, conservative treatment is generally recommended for individuals with a less physically demanding lifestyle and a lower risk of re-injury, among other factors.[3] When treating adults with ACL tears, it is essential to consider their rehabilitation goals, any concomitant knee-specific comorbidities, and their willingness to adhere to a structured rehabilitation regimen.[3]

For young and physically active individuals, return to sports (RTS) is widely regarded as one of the key indicators of a successful ACLR. Current data suggest that only about half of individuals undergoing ACLR resume their original level of activity.[4,5] Furthermore, up to 30% of athletes sustain a re-injury of the ACL within 24 months of RTS.[6] Physical function deficiencies significantly influence long-term outcomes, with poor physical performance at the end of rehabilitation predicting suboptimal patient-reported outcomes at 2 and 5 years, irrespective of the treatment approach.[7]

Additionally, increasing attention is being paid to the role of psychosocial factors in affecting physical function in sportspersons following ACLR. Less favorable patient-reported outcomes and knee function have been associated with a lack of knee confidence, fear of re-injury, psychological unreadiness to RTS, and decisions not to resume prior levels of sporting activity.[8-11] The Tampa Scale for Kinesiophobia (TSK-11), a fear-avoidance model assessment, is frequently employed to evaluate outcomes in ACLR studies.[11] Notably, a higher TSK-11 score at RTS (≥17) has been linked to a four-fold increased likelihood of poorer functional outcomes.[12] Additionally, patients with a TSK-11 score exceeding 18 at RTS were found to be thirteen times more likely to sustain another ACL injury within 2 years of RTS.[12]

Despite these findings, there remains a gap in the literature explaining the generally low frequency of RTS among young, previously active individuals following ACLR. Understanding and addressing these causative factors could enable healthcare providers and rehabilitation teams to better assist

patients in their transition back to sports. This study aimed to assess the frequency of RTS in individuals who actively participated in sports before their injury and underwent ACLR, and to identify factors influencing RTS.

METHODS

After obtaining approval from the Institutional Review Board for this analytical, cross-sectional study, patients were selected from the hospital's electronic records who had received ACLR from January 2016 to June 2021 in Liaquat National Hospital Karachi, Pakistan. Prospective participants were contacted by the researchers via their cellphone numbers and invited to take part in the study, once determined to be eligible per the predetermined inclusion criteria. The selected inclusion criteria required patients to be between 15 and 35 years of age, regardless of gender, with a pre-injury score of 4 or greater using the Tegner Activity scale, who had had primary ACLR at minimum 12 months before, had completed their rehabilitation, and had been given the go-ahead from their surgeons and their team of rehabilitation experts to resume their former, pre-injury level of physical activity. Patients who had had ACL injury more than once, who had sustained multi-ligamentous knee injuries or concomitant injuries or surgeries beyond ACLR, as well as currently pregnant females were excluded.

The researchers collected data concerning the patient's gender, age, type and frequency of pre-injury and post-injury sports participation, time from injury to surgery, time since the surgery, and factors affecting the decision to not return to sports. To facilitate this inquiry, the researchers created a comprehensive questionnaire. Patients were then grouped into those who returned to sports and those who did not, all of whom were assessed using the Lysholm/Tegner score, the International Knee Documentation Committee's (IKDC) subjective knee evaluation form, as well as the Tampa Scale for Kinesiophobia (TSK-11) to gauge the pre-injury and post-injury activity levels, current knee function, and degree of kinesiophobia, respectively. None of these scoring scales have copyright restrictions.

Data was analyzed using IBM Statistical Software for Social Sciences (SPSS Ver 23). The normality of the data will be checked by the One-sample Kolmogorov-Smirnov test for Normality. Mean and standard deviation (SD) were reported for quantitative variables i.e. age, time from injury to surgery, number of clinic visits before surgery, time since surgery, types of sport participation, length of time before returning to sports, IKDC, and TSK-11 scores. Median with interquartile range (IQR) was presented if the data was non-normal, instead of mean and SD. Frequency and percentage will be presented for categorical variables i.e. gender, employment status, side of the injury, type of sport, return to sport, level of return to sports, and reasons for not returning to sports. The chi-square test/Fischer exact test was applied for association between categorical variables. Student t-test was used to find the mean difference between the participants who returned and those who did not return to sports. A p-value of less than 0.05 was considered significant. Logistic regression will be used to determine the significant factors which will affect RTS after ACLR, whilst also providing the odd ratios for RTS.

RESULTS

The investigators contacted 336 patients who were eligible to take part in the study, out of which 109 responded and consented to participate (response rate: 32.14%). These participants were predominantly male (95.4%, n=104), with mean age of 29 ± 5.7 years. An almost equal number of left (47.7%, n=52) and right (52.3%, n=57) knees were operated during this period. Sports most frequently played were moderate to high impact team sports such as cricket (49.5%, n=54) and football (41.3%, n=45) while remaining sports including volleyball, badminton, basketball, and squash. The frequency of sports per week on average was 3.7 ± 2.18. The remaining sample characteristics have been summarized in Table I.

Patients were grouped into those who had returned to sports and those who had not, and the independent sample t-

Table I: Comparison of sample characteristics between the two groups of participants

Sample Characteristics	Return to sports		p- value
	Yes	No	
Age in years	28.53 ± 5.96	29.70 ± 5.35	0.24
Time from injury to surgery (in months)	22.64 ± 34.50	18.80 ± 25.22	0.51
Number of clinic visits before surgery	3.48 ± 1.72	3.40 ± 1.40	0.56
Time since surgery (in years)	4.26 ± 1.35	4.40 ± 1.32	0.57
Pre-injury frequency of sports/week	3.83 ± 2.35	3.62 ± 1.99	0.61
Time from surgery to resuming sports (in months)	9.92 ± 4.73	–	–

Table II: Mean and standard deviation of post-ACLR TSK-11, Lysholm, and IKDC scores of participants

Score	RTS	No RTS	Significance
TSK-11	37.44 ± 5.39	44 ± 5.37	p<0.05
Lysholm score	95.45 ± 9.22	85.82 ± 15.08	p<0.05
IKDC score	73.76 ± 5.13	67.04 ± 6.07	p<0.05

RTS: Return to sports; IKDC: International Knee Documentation Committee; ACLR: Anterior Cruciate Ligament Reconstruction; TSK: Tampa score for Kinesiophobia

Table III: Correlation between kinesiophobia, activity levels, and knee function scores

Score		TSK score	IKDC score	Lysohlm score	Current Tegner score
TSK score	Pearson correlation	–	-0.490	-0.497	-0.514
	Significance (p-value)	–	<0.001	<0.001	<0.001
IKDC score	Pearson correlation	-0.490	–	-0.506	-0.466
	Significance (p-value)	<0.001	–	<0.001	<0.001
Lysohlm score	Pearson correlation	-0.497	-0.506	–	-0.552
	Significance (p-value)	<0.001	<0.001	–	<0.001
Current Tegner score	Pearson correlation	-0.514	-0.466	-0.552	–
	Significance (p-value)	<0.001	<0.001	<0.001	–

IKDC: International Knee Documentation Committee; TSK: Tampa score for Kinesiophobia

test was used to analyze differences in sample characteristics between these two groups. There were no significant differences observed in terms of age, number of clinic visits before surgery, time since surgery, or the type and frequency of sports participation per week (Table I).

The mean Tegner score of the sample population before injury was 6.46 ± 0.87, reflecting participation in both recreational and competitive sports. The frequency of return to sports after ACLR was 54.1% (n=59), amongst only 16.9% (n=10) returned to performance at pre-injury levels of sports, whereas 35.6% (n=21) did return to previous levels of sports but were not able to perform at desired levels, and approximately half (47.5%, n=28) returned to participation in sports at a lesser level than before the injury. The mean time before resuming sports was about 10 months (9.9 ± 4.73). When comparing RTS amongst those who played soccer and those who played cricket before the injury, there was no significant difference observed in RTS (49.2%, n=54 vs 42.4%, n=46, p-value> 0.05).

The time from surgery of patients included in the study was an average of 4.32 ± 1.3 years after ACLR. There was a significant difference ($p < 0.05$) observed between those who had returned to sports and those had not in their current Tegner scores [median: 6 (IQR: 5-7) vs 4 (IQR:3-4), p-value <0.05), Tampa scores for kinesiophonia (mean: 37.44 vs. 44, p-value <0.05), Lysholm (mean: 95.45 vs. 85.82, p-value < 0.05) and IKDC scores (mean: 73.76 vs. 67.04, p-value <0.05), as summarized in Table II, thus signifying lower kinesiophobia and higher knee function and activity levels to be associated with RTS.

Co-relation between these scores was analyzed, showing a negative, significant correlation between the TSK-11 scores and the rest of the scores amongst both groups (p-values <0.001), indicating that lower scores of kinesiophobia are associated with better knee function and higher activity levels, and vice versa (see Table III). It was also interesting to observe an excellent correlation between the IKDC and Lysholm-Tegner scores (Pearson correlation -0.506, p-value <0.001), suggestive of good validity and reliability of both scores when used independently (see Table III).

DISCUSSION

This study included 109 individuals, with a mean follow-up of 4.32 ± 1.3 years after ACLR. Approximately half of the participants (54.1%, n=59) returned to some level of sporting activity, with a mean return time of 9.92 ± 4.73 months post-surgery. However, among those who resumed sports, only 16.9% (n=10) achieved pre-injury performance levels, while the remainder were unable to reach their previous level of performance. To evaluate patient-reported knee function and current activity levels, the investigators utilized well-validated scoring systems, including the IKDC and Lysholm scores. Activity levels were assessed using the Tegner score, while the Tampa Scale for Kinesiophobia (TSK-11), a widely used fear-avoidance assessment tool in ACLR outcome studies,[11] was employed to measure the degree of kinesiophobia in these individuals. There was a significant difference ($p < 0.05$) observed between those who had returned to sports and those had not in their current Tegner scores [median: 6 (IQR: 5-7) vs 4 (IQR:3-4), p-value <0.05), Tampa scores for kinesiophonia (mean: 37.44 vs. 44, p-value <0.05), Lysholm (mean: 95.45 vs. 85.82, p-value < 0.05) and IKDC scores (mean: 73.76 vs. 67.04, p-value <0.05), thus signifying lower kinesiophobia and higher knee function and activity levels to be associated with RTS. A significant correlation was found between the TSK-11 scores and the rest of the scores amongst both groups (p-values <0.001), indicating that lower scores of kinesiophobia are associated with better knee function and higher activity levels, and vice versa (Table III). An excellent correlation was observed between the IKDC and Lysholm-Tegner scores (Pearson correlation -0.506, p-value <0.001), suggestive of good validity and reliability of both scores when used independently (Table III).

Literature has demonstrated highly variable frequencies of return to sports following ACLR.4,5,8, [10,11] Alswat MM, etal., conducted a study in Saudi Arabia on a population with similar sample characteristics, being predominantly male (98.9%), and followed them after a mean of 4.7 ± 2 years.[11] They found that although a larger proportion of their sample population (61.3%) did return to sports, less than one-third (29%) returned to pre-injury levels of sports[11] Ardern CL, et al., studied 314

individuals after a mean of more than 3 years after ACLR and found that led than half of them (45%) were playing at pre-injury levels.[4] However, the same author, in a systematic review including 69 articles and 7556 participants, revealed that 81% of individuals returned to some sort of sports after ACLR, which is significantly higher than the frequency of RTS in our study.[5] A reasonable explanation for these varied results could be a higher proportion of competitive athletes in some of these studies, in whom there are higher odds of returning to sports, as well as a lack of a standardized method to identify the level of sporting activity these participants returned to.[5]

While some studies show evidence that certain sports are linked to higher frequencies of RTS, such as jogging and cycling, but since most individuals in this study played cricket or football, our data is mostly built on these sports.[11,13] The frequency of RTS, and the mean time from surgery to RTS, did not significantly vary between players of these two sports in this study.

Alswat MM,et. al., and Hart HF, et al., both indicated that the greater the degree of kinesiophobia (reflected by higher TSK-11 scores), the poorer the patient-reported outcome and IKDC score, a finding consistent with the findings in this study.[10,11] Burland JP, et al., after identifying the predominant factors related to kinesiophobia in ACl injured athletes, suggested that rehabilitative settings address factors that are directly related to knee function, such as reluctance, lack of confidence, and fear of re-injury.[8] While Alswat MM, et al., did demonstrate lower TSK-11 scores ($p<0.001$) and higher IKDC scores ($p = 0.002$) in individuals returning to sports, we further analyzed these findings in our study and found a significant ($p <0.001$), negative correlation between TSK-11 scores and IKDC as well as Lysholm scores (Pearson correlation: -0.490 and -0.497, respectively). This is a significant result that reflects the need to address the psychological factors affecting the rehabilitation of these young individuals who seem to have fairly decent outcomes after surgery but fail to return to pre-injury levels of sports. It also demonstrates an excellent correlation between the IKDC and Lysholm scores, suggestive of good validity of both scores even when used independently.

This study highlights the low rate of return to pre-injury levels of sports following ACLR, despite achieving relatively satisfactory knee functional outcomes post-operatively. The findings suggest that the decision to return to sports is influenced by multiple factors, underscoring the need for an interdisciplinary approach that addresses both physical and psychosocial aspects during the rehabilitation process.

However, this study has certain limitations, including underrepresentation of female participants, a limited number of competitive athletes in the sample, a relatively small sample size, and its single-center design.

CONCLUSION

This study reveals that while approximately half of the individuals return to some level of sports following ACLR, the frequency of returning to pre-injury performance levels is significantly lower, despite achieving relatively favorable post-operative knee functional outcomes. Those who did not return to sports exhibited higher kinesiophobia scores, which were associated with poorer knee function and reduced activity levels. These findings underscore the critical role psychosocial factors play in influencing the decision of young individuals not to return to sports after ACLR. Therefore, implementing a multidisciplinary approach that addresses both physical and psychological aspects of recovery is recommended to support athletes in successfully returning to sports following ACLR.

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AUTHORS' CONTRIBUTIONS

Following authors have made substantial contributions to the manuscript as under:

MZ: Conception and study design, acquisition of data, drafting the manuscript, approval of the final version to be published

SK: Acquisition, analysis and interpretation of data, drafting the manuscript, critical review, approval of the final version to be published

KN, MS & MA: Acquisition of data, critical review, approval of the final version to be published

DK: Acquisition of data, drafting the manuscript, approval of the final version to be published

GB & KS: Acquisition, analysis and interpretation of data, drafting the manuscript, approval of the final version to be published

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

CONFLICT OF INTEREST

Authors declared no conflict of interest, whether financial or otherwise, that could influence the integrity, objectivity, or validity of their research work.

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DATA SHARING STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request