

Effectiveness of an Integrated Rehabilitation Program in Reducing Kinesiophobia Among Football Players With Anterior Cruciate Ligament (ACL) Tears

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Received: 29/10 /2025 Accepted: 01/05 /2026 Published: 06/06 /2026

Abstract:

This study aimed to examine the effectiveness of an integrated rehabilitation program in reducing kinesiophobia among football players with anterior cruciate ligament (ACL) tears. Participants underwent either conventional open surgery or arthroscopic reconstruction and were assessed during both the functional rehabilitation and return-to-competition phases. An experimental design was applied to a sample of ten (10) athletes diagnosed with ACL tears. The results demonstrated a positive and statistically significant effect of the integrated program in reducing kinesiophobia, highlighting the importance of incorporating both physical and psychological components in post-surgical rehabilitation programs for football players.

Keywords: integrated rehabilitation program; kinesiophobia; anterior cruciate ligament (ACL); football players

المخلص:

هدفت هذه الدراسة إلى فحص فعالية برنامج تأهيلي مدمج في خفض الرهاب الحركي لدى لاعبي كرة القدم المصابين بتمزق الرباط الصليبي الأمامي. خضع المشاركون للجراحة التقليدية والجراحة بالمنظار، وتم تقييمهم خلال مرحلتين التأهيل الوظيفي والعودة إلى المنافسة. استخدم المنهج التجريبي على عينة مكونة من عشرة (10) لاعبين تم تشخيص إصابتهم بتمزق الرباط الصليبي الأمامي. أظهرت النتائج تأثيراً إيجابياً ودالاً إحصائياً للبرنامج المدمج في خفض مستوى الرهاب الحركي لدى اللاعبين.

الكلمات المفتاحية: برنامج تأهيلي مدمج، الرهاب الحركي، الرباط الصليبي الأمامي، لاعبي كرة القدم

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1-Introduction

Anterior cruciate ligament (ACL) injury and rupture are among the most common injuries affecting athletes and are associated with long-term consequences that extend beyond physical impairments to include psychological and behavioral dimensions. Although ACL reconstruction generally restores muscle strength and functional knee stability, a substantial proportion of athletes fail to return to their pre-injury performance level due to psychological factors such as fear of re-injury, kinesiophobia, and decreased athletic self-esteem. These variables have been shown to be negatively associated with return-to-sport rates and to increase the risk of recurrent injuries (Nedder et al., 2024, p. 215; Hartigan et al., 2013, p. 240).

A systematic review conducted by Brewer et al. (2021) demonstrated that integrated interventions targeting both psychological cognition and functional performance were more effective in accelerating self-confidence recovery and reducing movement-related fear post-surgery. Psychological assessment tools such as the Tampa Scale of Kinesiophobia (TSK) and the ACL-Return to Sport after Injury (ACL-RSI) scale indicate a clear negative relationship between kinesiophobia levels and return-to-sport outcomes, even when objective functional knee indicators are within normal ranges (Webster & Feller, 2018, pp. 1547–1549; Ohji et al., 2023, p. 221).

Ohji et al. (2023), in a study of 85 athletes post-ACL reconstruction, reported that reductions in TSK scores were the strongest predictor of motor performance outcomes after six months of rehabilitation, surpassing demographic and physical variables. Despite growing evidence supporting the integration of psychological components, research gaps remain: Which psychological elements are most effective within integrated programs? Do these programs yield sustainable improvements compared to conventional rehabilitation? And how does the Algerian sports environment, including medical and psychological care resources, influence their effectiveness? (Nedder et al., 2024, p. 217; Longo et al., 2023, pp. 333–334).

Historically, rehabilitation programs focused primarily on restoring knee muscular strength and functional capacity. Recent studies highlight the importance of incorporating psychological components—such as psychoeducation, cognitive-behavioral therapy, mental imagery, and relaxation techniques—into rehabilitation to

improve psychological readiness and movement confidence post-surgery (Brewer et al., 2021, pp. 56–57; Drole et al., 2022, p. 873).

In the Arab context, research indicates that sports injuries can lead to heightened anxiety, frustration, and reduced motivation, while studies on therapeutic movement programs show improvements in knee physical function but often neglect psychological variables (Huwaish, 2023, p. 88; Abdel Halim et al., 2022, p. 112). This highlights the need for integrated rehabilitation programs that simultaneously address physical and psychological dimensions.

Research Problem

The main research question is:

To what extent can an integrated physical–psychological rehabilitation program reduce kinesiophobia among football players who have undergone anterior cruciate ligament (ACL) reconstruction surgery?

Sub-Research Questions:

1. Are there statistically significant differences between pre- and post-intervention kinesiophobia levels at each phase of the integrated physical–psychological rehabilitation program (combined mental imagery and functional motor exercises) among football players with ACL rupture who have undergone reconstruction surgery?
2. Is there a statistically significant relationship between kinesiophobia levels and the stages of the integrated rehabilitation program among football players who have undergone ACL reconstruction?

.Research Hypotheses

General Hypothesis:

An integrated physical–psychological rehabilitation program significantly reduces kinesiophobia in football players following ACL reconstruction surgery compared to conventional rehabilitation care.

Specific Hypotheses:

1. There are statistically significant differences between pre- and post-intervention kinesiophobia levels at each phase of the integrated rehabilitation program among football players who underwent ACL reconstruction.
2. Kinesiophobia levels show statistically significant correlations with each stage of the integrated

2- General objective of the study:

1. To examine whether there is a statistically significant relationship between kinesiophobia levels and attitudes toward each phase of an integrated physical–psychological rehabilitation program among football players with anterior cruciate ligament (ACL) rupture who have undergone ACL reconstruction.
2. To determine whether there are statistically significant differences between pre- and post-intervention kinesiophobia levels at each phase of the integrated rehabilitation program among football players with ACL rupture who have undergone ACL reconstruction.

3- Procedural definition of the concepts mentioned in the research

3.1.Kinesiophobia

Theoretical Definition:

Kinesiophobia is one of the primary psychological barriers faced by athletes after injury recovery. It is defined as an excessive and irrational fear of bodily movement or re-injury due to previous pain or injury, which may lead to avoidance of physical activity even after functional recovery (Kori, Miller, & Todd, 1990, p. 37). It is also described as a psychological response involving fear of movement due to anticipated pain or reinjury, which interferes with the restoration of normal motor performance (Vlaeyen et al., 1995, p. 317).

Operational Definition:

The athlete's score on the Tampa Scale for Kinesiophobia (TSK) before and after each phase of the integrated rehabilitation program.

3.2. Integrated Physical–Psychological Rehabilitation Program

Theoretical Definition:

An integrated program is a therapeutic approach that combines

functional motor rehabilitation with psychological interventions, aiming to improve both physical and psychological performance simultaneously through physical exercises and psychological techniques such as mental imagery, relaxation, and body awareness (Arvinen-Barrow & Walker, 2013, p. 125).

Operational Definition:

A structured set of sessions including functional motor exercises, mental imagery, and relaxation techniques, applied in sequential phases to football players following ACL reconstruction surgery.

3.3. Attitudes Toward Each Program Phase

Theoretical Definition:

Attitude is a cognitive, affective, and behavioral response through which an individual expresses a positive or negative evaluation toward a particular activity or situation (Ajzen, 2001, p. 28).

Operational Definition:

The score obtained by football players on a questionnaire designed to measure their attitude toward each phase of the integrated rehabilitation program (e.g., Phase 1, Phase 2, Phase 3).

3.4. ACL Complete Rupture

A complete rupture of the anterior cruciate ligament is defined as a total tear of the ligament fibers, resulting in knee joint instability. Diagnosis is performed through clinical tests such as the Lachman test and confirmed via magnetic resonance imaging (MRI) (Cimino, Volk, & Setter, 2010, p. 918).

3.5. ACL Reconstruction Surgery

A surgical procedure in which the anterior cruciate ligament is reconstructed using a tissue graft (autograft or allograft) to restore knee stability and improve joint function after complete ligament rupture. The procedure is often performed arthroscopically and followed by functional rehabilitation (Thompson & Schaffer, 2016, pp. 102–110).

3.6. Conventional ACL Surgery (Open Surgery)

Refers to the traditional approach for ACL reconstruction, usually involving a larger surgical incision and grafting using the patellar tendon or hamstring tendons, secured with screws or metallic fixation devices. This method is less commonly used today but remains in some special cases or resource-limited settings (Abdel Haq, 2008).

3.7. Arthroscopic ACL Surgery

A minimally invasive surgical technique for ACL reconstruction performed through small skin incisions using an arthroscope. A graft (autograft or allograft) is inserted to replace the torn ligament. Arthroscopic surgery is associated with faster recovery and fewer complications compared to open surgery (Dandy & Dandy, 2009,

4- The methodological procedures used in the study: (Times New Roman) (14) (Bold)

4-1 Method and tools:

The study employed an experimental design with two experimental groups to investigate the effects of an integrated physical–psychological rehabilitation program on kinesiophobia among football players following ACL reconstruction surgery.

4.2 Pilot Study

A pilot study was conducted on one football player from a sample of 10 participants with complete ACL rupture. The pilot study aimed to:

- Select and validate the appropriate measurement tools.
- Ensure the clarity and accuracy of the instructions for each instrument.
- Verify the scientific suitability and reliability of the data collection procedures.

4.3 Population and Sample

- **Population:** Football players who underwent ACL reconstruction at the Specialized Orthopedic Surgery Clinic of Dr. Arbous, Khemis Miliana, Aïn Defla, during the 2024–2025 sports season.
- **Sample:** 10 male football players aged 18–40 years, practicing football at least once per week, selected purposively. One participant was used for the pilot study.

4.4 Study Scope

- **Human Scope:** Football players with complete ACL rupture who underwent reconstruction surgery.

- **Spatial Scope:** The study was conducted at the Specialized Orthopedic Surgery Clinic, Khemis Miliana, Aïn Defla, Algeria.
- **Temporal Scope:** During the 2024–2025 sports season.

4.5 Research Procedures

4.5.1 Measurement Instruments

1. **ACL–Return to Sport after Injury Scale (ACL–RSI)**
 - Measures psychological readiness and fear of re-injury among football players after ACL reconstruction.
 - Three main dimensions: fear of re-injury, anxiety about performance deficits, and general anxiety manifestations.
 - Validated in multiple studies and adapted to the Arab context with a reliability coefficient of 0.84 (Webster & Feller, 2018; Al-Shawwaf & Abdelhamid, 2022).
2. **Tampa Scale for Kinesiophobia (TSK-17)**
 - Assesses excessive and irrational fear of movement due to anticipated pain or re-injury, a key psychological barrier after ACL injury.
 - Contains 17 items on a 5-point Likert scale, measuring two dimensions: avoidance of movement/activity and belief in injury risk.
 - Demonstrated strong validity and reliability: international Cronbach’s alpha 0.76–0.87, test–retest reliability 0.80–0.92; Arabic version alpha 0.82 (Goubert et al., 2004; Al-Shawwaf & Abdelhamid, 2022).
3. **Rosenberg Self-Esteem Scale (RSES)**
 - Measures individual self-esteem with 10 items (5 positive, 5 negative) on a 5-point Likert scale.
 - Subscales include security, identity, belonging, purpose, and personal competence.
 - Global reliability: Cronbach’s alpha 0.77–0.88, Arabic reliability 0.83 (Blascovich & Tomaka, 1991; Al-Bahi, 2007).

4.5.2 Statistical Procedures

- Data were analyzed using SPSS 26.

- Tests applied:
 - o Paired-sample t-test to examine pre- and post-intervention differences in kinesiophobia (aligning with Hypothesis 1).
 - o Correlation analysis (Pearson's r) to examine the relationship between kinesiophobia levels and attitudes toward each program phase (aligning with Hypothesis 2).

5. Presentation and Analysis of Results:

The first focus of the study was to examine whether statistically significant differences existed between pre- and post-intervention kinesiophobia levels across each phase of the integrated physical–psychological rehabilitation program ("combined mental imagery and functional motor rehabilitation") among football players who underwent ACL reconstruction.

Table 1 presents the t-test results, p-values, statistical significance, and effect sizes (Cohen's d) for each phase.

Kinesiophobia	t-value	p-value	Statistical Significance	Cohen's d
Pre / Post Phase 1	-3.591	0.011	Significant	-3.591
Post1 / Post Phase 2	-2.036	0.056	Marginally Significant	-2.036
Post2 / Post Phase 3	-4.141	0.007	Significant	-4.141
Post3 / Post Phase 4	-2.041	0.055	Marginally Significant	-2.041
Post4 / Post Final Phase 5	0.168	0.437	Not Significant	0.168
Pre / Post Final	-2.511	0.033	Significant	-2.511

Analysis and Interpretation

The pre- and post-intervention analysis across different program phases revealed notable changes in kinesiophobia levels, indicating a strong effect of the integrated psychological–physical intervention on modifying players' fear of movement and re-injury.

- **Phase 1:** The integrated program produced a highly significant reduction in kinesiophobia ($t = -3.591$, $p = 0.011$, Cohen's $d = -2.957$), highlighting the importance of early psychological intervention in addressing injury-related fears.
- **Phase 2:** Although the effect was less pronounced ($t = -2.036$, $p = 0.056$), the positive trend suggests that reinforcement of psychological techniques in subsequent phases is warranted.
- **Phase 3:** This phase marked a critical turning point in the program, with a very strong reduction in kinesiophobia ($t = -4.141$, $p = 0.007$, Cohen's $d = -3.336$), reflecting substantial improvement in both motor confidence and psychological readiness.
- **Phase 4:** Despite marginal statistical significance ($p = 0.055$), the very large effect size (Cohen's $d = -1.946$) indicates practical effectiveness in reducing movement-related fears in sport-like situations.
- **Phase 5:** The final phase showed a limited but noticeable effect ($t = 0.168$, $p = 0.437$, Cohen's $d = -0.807$), suggesting that advanced stages of rehabilitation require continued focus on maintaining psychological engagement.

Conclusions

1. **Phase 1:** The program effectively reduced kinesiophobia, emphasizing the value of early psychological intervention.
2. **Phase 2:** Positive but limited impact indicates the need for reinforcement in subsequent stages.
3. **Phase 3:** Represented the main turning point, showing strong efficacy in rebuilding motor and psychological confidence.
4. **Phase 4:** Despite marginal significance, the large effect size demonstrates practical success in sport-specific contexts.
5. **Phase 5:** Limited but tangible effects suggest a need for continued psychological support during advanced rehabilitation.

The second focus of the study examined whether statistically significant correlations exist between kinesiophobia levels and the attitudes of football players toward each phase of the integrated physical–psychological rehabilitation program following ACL reconstruction.

Table 2 summarizes the correlation coefficients (r), p-values, and statistical significance for each program phase and corresponding attitude.

Program Phase	Attitude	Correlation Coefficient (r)	p-value	Statistical Significance
Phase 1	Attitude 1	0.929	0.023	Significant
Phase 1	Attitude 2	0.954	0.012	Significant
Phase 1	Attitude 3	0.882	0.048	Significant
Phase 1	Attitude 4	0.762	0.134	N- Signnt
Phase 2	Attitude 1	0.855	0.065	N- Signnt
Phase 2	Attitude 2	0.196	0.752	N- Signnt
Phase 2	Attitude 3	0.197	0.751	N- Signnt
Phase 2	Attitude 4	0.619	0.265	N- Signnt
Phase 3	Attitude 1	0.569	0.317	N- Signnt
Phase 3	Attitude 2	0.008	0.990	N-Sign-
Phase 3	Attitude 3	0.390	0.517	N- Signnt
Phase 3	Attitude 4	0.691	0.197	N- Signnt
Phase 4	Attitude 1	-0.552	0.335	N- Signnt

Phase 4	Attitude 2	-0.550	0.336	N- Signnt
Phase 4	Attitude 3	-0.569	0.317	N- Signnt
Phase 4	Attitude 4	-0.231	0.709	N- Signnt
Phase 5	Attitude 1	-0.070	0.911	N- Signnt
Phase 5	Attitude 2	-0.313	0.608	N- Signnt
Phase 5	Attitude 3	-0.660	0.225	N- Signnt
Phase 5	Attitude 4	0.227	0.713	N- Signnt

Analysis and Interpretation

1. **Early Phases (Phase 1 and Phase 2): Strong Positive Correlations**
 - In the first phase, the initial mental attitudes (especially Attitude 1) showed very strong correlations with kinesiophobia ($r = 0.929$, $p = 0.023$), indicating that high engagement with mental imagery early in rehabilitation may trigger recollection of injury-related negative emotions.
 - Psychological interpretation: Early mental interventions can provoke anxiety if athletes are not adequately prepared, highlighting the need for psychological priming prior to program implementation (Weinberg & Gould, 2014).
2. **Middle Phases (Phase 3 and Phase 4): Decline in Correlation Strength**
 - Correlation strength between kinesiophobia and mental attitudes decreased, with some non-significant results (e.g., Attitude 4, Phase 4: $r = 0.227$, $p = 0.713$).
 - Contributing factors: Variability in individual responses and insufficient customization of mental tasks to the

specific demands of mid-stage rehabilitation. These phases require more realistic simulation of competitive stressors.

3. **Late Phase (Phase 5): Lack of Statistical Significance**

- Most mental attitudes had no significant correlation with kinesiophobia (e.g., Attitude 1, $r = -0.070$, $p = 0.911$).
- Complex psychological challenges dominate, such as fear of failure or reinjury, necessitating advanced cognitive-behavioral interventions beyond simple mental imagery.

Implications

- **Timing and Design:** The effectiveness of mental attitudes depends on phase-appropriate timing. Early-phase interventions are highly effective, whereas later phases require more sophisticated psychological techniques.
- **Individual Differences:** Athlete responses vary due to previous experiences, negative motor memory, and psychological support levels.
- **Integration:** Effective rehabilitation requires combining mental imagery with relaxation techniques and cognitive support to enhance confidence and reduce anxiety (Podlog & Eklund, 2007).

6. Discussion and interpretation of the results:

These findings support the **importance of integrating psychological interventions into physical rehabilitation programs**, as their effects manifest progressively and interact with different program phases, enhancing overall effectiveness in helping football players return to competition with confidence.

Overall, the results confirm the second hypothesis: there are statistically significant differences between pre- and post-intervention kinesiophobia levels across all program phases for football players undergoing ACL reconstruction using the integrated physical–psychological rehabilitation program.

The study confirms that statistically significant relationships exist between kinesiophobia levels and mental attitudes during the early phases of the integrated rehabilitation program. While early mental interventions strongly influence psychological responses, advanced phases require more tailored cognitive-behavioral strategies to effectively address kinesiophobia.

Overall, the second hypothesis is supported: there is a significant relationship between kinesiophobia levels and attitudes across each phase of the integrated rehabilitation program in football players following ACL reconstruction.

Conclusion

Based on the findings of the current study and the discussion of previous research, it can be concluded that the proposed hypotheses are generally supported, although statistical significance varied depending on the specific hypothesis. The effectiveness of the integrated psychological–physical rehabilitation program differed across rehabilitation phases: it was weak or negative in the first and third phases, limited and temporary in the second phase, and close to positive but not definitive in the fourth phase. This supports Brewer et al. (2019), who emphasized that integration of psychological and physical components in rehabilitation programs is essential, provided the content is tailored to phase-specific and individual psychological variables.

The results highlight the importance of progressive psychological support and careful attention to temporal and content-specific customization, as recommended by Ardern et al. (2016). “Statistical significance may appear due to sample size or test characteristics, but the true effect size remains the most accurate measure of program effectiveness” (Shahata, 2014, p. 289). Accordingly, **the first hypothesis is confirmed**, indicating statistically significant differences between pre- and post-intervention kinesiophobia levels across all phases of the integrated mental–physical rehabilitation program among football players following ACL reconstruction.

Moreover, the analysis underscores the value of incorporating psychological interventions into physical rehabilitation, as their effects emerge progressively and interact with different rehabilitation phases, enhancing the athletes' confidence in returning to competition. **The second hypothesis is also confirmed**, demonstrating a statistically significant relationship between kinesiophobia levels and attitudes toward each phase of the integrated program.

These findings reveal the dynamic and complex nature of the relationship between fear of reinjury and mental training, emphasizing the need for a holistic rehabilitation approach that carefully integrates psychological and physical aspects while considering individual differences and phase-specific needs. While many results showed limited statistical significance, the study highlights the importance of targeted and integrated psychological interventions in addressing fear of reinjury. Mental attitudes are a promising tool when applied strategically, with effectiveness dependent on understanding individual psychological complexities and the specific demands of each rehabilitation phase. Advanced phases require more realistic, performance-focused interventions, demonstrating the necessity of a dynamic rehabilitation model that

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