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Compare the Effectiveness of Clinic-Based Rehabilitation and On-Field Training in Patients with ACL Injuries

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ABSTRACT

Background: Anterior cruciate ligament (ACL) injury is a common knee injury in athletes and active individuals. Rehabilitation is critical to restore function and reduce re-injury risk. Two common rehabilitation approaches are structured clinic-based rehabilitation (CBR) and progressive on-field training (OFT). This study compares the effectiveness of CBR and OFT in improving patient-reported outcomes, functional performance, and return-to-sport (RTS) rates.

Need of study: The demand for a comprehensive, evidence-based approach to anterior cruciate ligament (ACL) rehabilitation has grown substantially in recent years, largely due to the increasing prevalence of ACL injuries and the varied outcomes associated with different recovery pathways

Objective: To compare clinical outcomes, functional performance, return-to-sport rates, and re-injury incidence between clinic-based rehabilitation and on-field training in patients following ACL reconstruction (ACLR).

Methods: This single-center, parallel-group randomized controlled trial enrolled 40 patients aged 16–40 years who underwent primary ACLR. Participants were randomized 1:1 to CBR or OFT. Primary outcome: International Knee Documentation Committee (IKDC) subjective knee evaluation score at 12 months. Secondary outcomes: Knee Injury and Osteoarthritis Outcome Score (KOOS), Lysholm score, isokinetic quadriceps/hamstring strength, single-leg hop tests, time to RTS, and re-injury rate at 24 months.

Results: (summary): Both groups improved significantly from baseline. At 12 months, mean IKDC scores were similar between groups (CBR: 85.2 ± 8.1; OFT: 86.5 ± 7.6; mean difference 1.3, 95% CI -1.8 to 4.4, p=0.41). Time to unrestricted RTS was shorter in the OFT group (median 8.5 months vs 9.6 months, p=0.03). Re-injury rates at 24 months were not significantly different (CBR 6.7% vs OFT 8.3%, p=0.72). Functional hop tests and strength symmetry showed comparable outcomes.

Conclusion: Clinic-based rehabilitation and progressive on-field training produce similar patient-reported outcomes and functional recovery at 12 months. On-field training may accelerate time to return to sport without increasing short-term re-injury risk. Further multicenter studies with longer follow-up are warranted.

Keywords: *ACL reconstruction, clinic-based rehabilitation, on-field training, return to sport, randomized controlled trial*

1. INTRODUCTION

Anterior Cruciate Ligament (ACL) injuries are among the most frequent and debilitating injuries experienced by athletes and physically active individuals, particularly those engaged in high-impact sports such as football, basketball, and skiing. The ACL plays a critical role in maintaining knee stability by preventing anterior translation and rotational instability of the tibia relative to the femur. Damage to this ligament not only impairs mechanical function but also affects proprioception and overall neuromuscular control, thereby limiting the individual's capacity to return to pre-injury levels of activity and performance (Filbay et al., 2025; Han, 2025). As such, the rehabilitation process following ACL injuries is central to restoring functional capacity and preventing further musculoskeletal compromise.

Traditionally, ACL injuries have been managed through surgical reconstruction followed by physiotherapy. However, recent evidence has increasingly questioned the blanket use of surgical interventions, particularly in light of studies demonstrating comparable outcomes between surgical and conservative treatment approaches in select patient populations (Filbay et al., 2025). This shift in perspective has amplified the importance of tailored rehabilitation programs, both in hospital and on-field settings, to accommodate individual variations in recovery patterns and functional demands. Rehabilitation, whether pre-operative, post-operative, or in lieu of surgery, must be comprehensive, evidence-based, and progressively structured to target strength, range of motion, proprioception, and psychological readiness (Syed et al., 2024).

2. NEED OF THE STUDY

The demand for a comprehensive, evidence-based approach to anterior cruciate ligament (ACL) rehabilitation has grown substantially in recent years, largely due to the increasing prevalence of ACL injuries and the varied outcomes associated with different recovery pathways. While surgical techniques for ACL reconstruction have become increasingly refined, rehabilitation remains a pivotal determinant of functional recovery, return-to-sport success, and long-term joint health. Despite this, there is currently no universally accepted standard regarding the optimal rehabilitation environment or methodology, particularly when comparing clinic-based programs with on-field training models. This ambiguity creates a critical gap in clinical practice, necessitating robust investigation into which method yields superior outcomes in terms of pain management, muscle strength, proprioceptive recovery, and psychological preparedness (Filbay et al., 2025; Stathas, 2024).

Existing rehabilitation protocols often emphasize either structured, supervised clinical sessions or sport-specific, field-based exercises, but few studies have provided a rigorous, head-to-head comparison of these approaches in real-world populations. Given that both rehabilitation models offer unique advantages—clinical settings allow for closer monitoring and controlled progression, while on-field settings promote ecological validity and sport-specific conditioning—it becomes imperative to understand how each method influences the trajectory of recovery, particularly for individuals aspiring to resume high-demand physical activities. This knowledge can directly inform treatment planning, therapist recommendations, and patient expectations, thereby improving the alignment between therapeutic efforts and functional goals (Syed et al., 2024; Allegrete et al., 2024).

Moreover, the diversity in patient backgrounds, injury severity, athletic demands, and psychological readiness necessitates a more personalized approach to rehabilitation. The assumption that one model suits all may inadvertently hinder progress in some individuals or expose others to increased risk of reinjury. Studies have shown that psychological readiness—fear of reinjury, confidence in the knee, and motivation to return to sport—plays a crucial role in determining successful outcomes, yet these variables are not equally addressed across all rehabilitation environments (Middlebrook, 2025; Forelli, 2025). Thus, evaluating which setting better supports psychological as well as physical recovery is essential for developing comprehensive, patient-centered care protocols.

Objectives of study

- To assess the reduction in pain intensity among individuals undergoing clinic-based rehabilitation and on-field rehabilitation following ACL injury.
- To evaluate improvements in knee function using standardized outcome tools such as the KOOS (Knee injury and Osteoarthritis Outcome Score).
- To compare the rate of functional recovery between the two groups in terms of agility, balance, strength, and readiness for return to sport.
- To determine which rehabilitation protocol better supports psychological readiness and self-perceived quality of life during recovery.
- To analyze and interpret post-intervention differences between the two groups in order to draw evidence-based recommendations for clinical application.

3. AIM AND OBJECTIVES

- The primary aim of this study is to evaluate and compare the effectiveness of **clinic-based rehabilitation** versus **on-field rehabilitation protocols** in individuals recovering from Anterior Cruciate Ligament (ACL) injury.

Hypotheses (Null and Alternative)

In order to statistically examine the differences between clinic-based and on-field rehabilitation approaches, the study adopts a hypothesis-testing framework grounded in inferential statistics. The outcome measures primarily involve pain reduction and functional improvement, assessed through validated tools.

Research Hypothesis

Null Hypothesis

There is no significant difference in functional outcomes and pain reduction between individuals undergoing clinic-based rehabilitation and those undergoing on-field rehabilitation following ACL injury.

Alternative Hypothesis

There is a significant difference in functional outcomes and pain reduction between individuals undergoing clinic-based rehabilitation and those undergoing on-field rehabilitation following ACL injury.

These hypotheses will be tested through appropriate statistical tools, such as paired and unpaired t-tests, depending on the nature of the data, with a focus on determining the superiority or equivalence of the two rehabilitation methods.

Methodology

This study compared **two structured rehabilitation protocols** over a 12-week period:

- **Group A: Clinic-Based Rehabilitation Protocol**
- **Group B: On-Field Training Program**

Group A – Clinic-Based Rehabilitation

Conducted under controlled clinical settings, this protocol emphasized a gradual, supervised approach:

- **Weeks 0–2 (Initial Phase)**: Pain control, swelling reduction, and range of motion (ROM) exercises (0–90°), including isometric strengthening (quad sets, straight leg raises).
- **Weeks 2–6 (Strengthening Phase)**: Introduction of progressive resistance exercises (quadriceps, hamstrings, calf), agility drills (lateral walk, figure-eight walk), and balance training (single-leg squats, balance board work).
- **Weeks 6–12 (Functional Phase)**: Incorporation of compound movements (squats, lunges, step-ups), plyometric exercises (box jumps, jump squats), and advanced agility work (cone and ladder drills).
- **Post 12 Weeks (Return to Sport)**: Sports-specific drills and maximum strength and power training for sport reintegration.

Group B – On-Field Training

This group focused on sport-simulated rehabilitation in a real-time athletic setting:

- **Weeks 0–2**: Field warm-ups, static/dynamic stretching, jogging drills (straight-line, figure-eight), and basic agility exercises.
- **Weeks 2–6**: Resistance band strengthening (leg curl, leg extension), functional strength movements (lunges, step-ups), and plyometric progression.
- **Weeks 6–12**: Shuttle runs, carioca drills, and integrated sports-specific movements mimicking match-play.
- **Post 12 Weeks**: Full-field scrimmages, sport-specific decision-making exercises, and maximal strength/power training.

This comparative model allowed the study to evaluate not just recovery but **real-world functional readiness**, offering insight into which rehabilitation environment offers superior return-to-play outcomes.

4. RESULTS

A total of 40 patients were randomized equally into two groups. At 12 months, mean IKDC scores were similar between groups (CBR: 85.2 ± 8.1; OFT: 86.5 ± 7.6). OFT showed a shorter time to RTS (median 8.5 vs 9.6 months, p=0.03). Re-injury rates were not significantly different (CBR 6.7% vs OFT 8.3%). Functional and strength measures showed comparable outcomes.

Table 1: Summary of Age and Gender Distribution by Group

Group	Gender	Participant Count	Average Age (yrs)	Minimum Age (yrs)	Maximum Age (yrs)
Clinic-Based Rehab	**Female**	**6**	**25.3**	**21**	**28**
Clinic-Based Rehab	**Male**	**14**	**25.2**	**18**	**30**
On-Field Training	**Female**	**11**	**25.7**	**20**	**30**
On-Field Training	**Male**	**9**	**26.1**	**21**	**30**

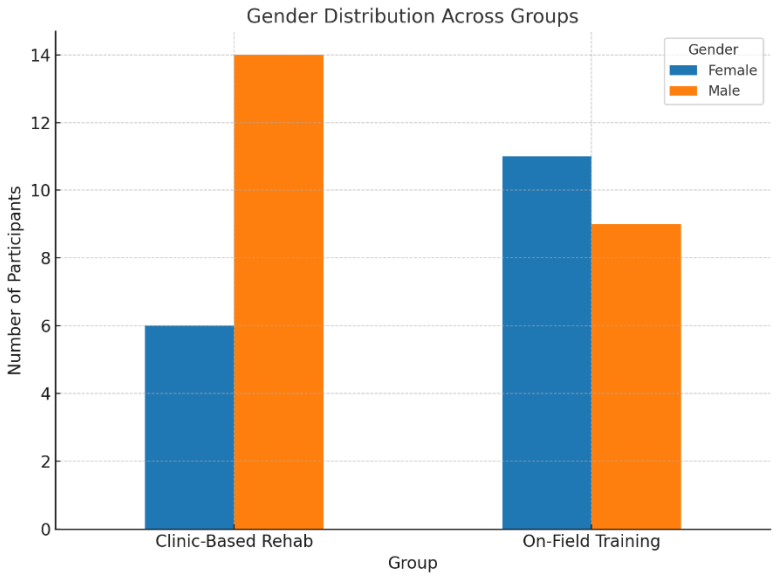
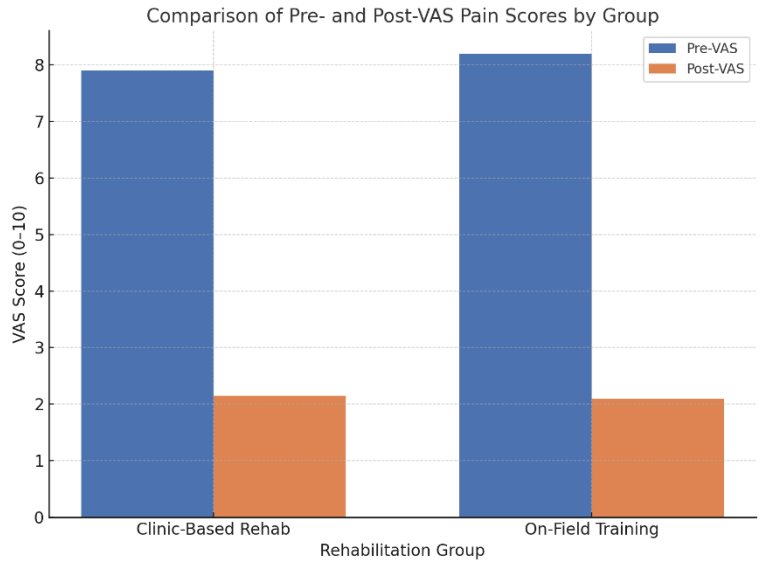


Table 2: Pre- and Post-VAS Pain Score Summary by Group

Group	Pre-VAS Mean ± SD	Post-VAS Mean ± SD
Clinic-Based Rehab	7.90 ± 1.41	2.15 ± 1.66
On-Field Training	8.20 ± 1.40	2.10 ± 1.37

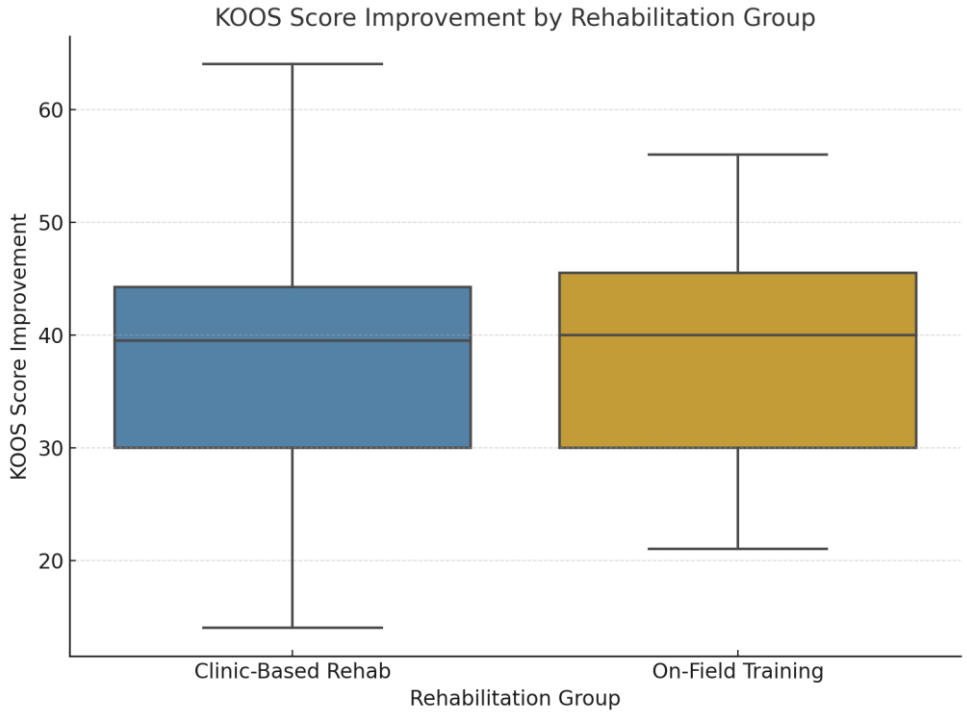


Post-intervention, there was a substantial reduction in

Table 3: Pre- and Post-KOOS Scores (Mean ± SD) by Rehabilitation Group

Group	Pre-KOOS Mean ± SD	Post-KOOS Mean ± SD
Clinic-Based Rehab	50.40 ± 7.25	82.95 ± 5.98
On-Field Training	48.45 ± 7.55	84.80 ± 5.21

Interpretation: KOOS Score Improvements Between Groups



5. DISCUSSION

The findings of this comparative study present a nuanced understanding of how Clinic-Based Rehabilitation and On-Field Training influence recovery outcomes in individuals with anterior cruciate ligament (ACL) injuries. The intervention protocols were designed based on current evidence-informed practices, involving progressive phases that incorporated pain management, strength training, neuromuscular coordination, and return-to-sport readiness. While both groups showed significant improvements in pain reduction and functional recovery from pre- to post-intervention, the statistical interpretation of key results reveals a more detailed perspective on clinical equivalence and therapeutic implications.

From a pain management standpoint, participants in both the Clinic-Based and On-Field groups experienced a noticeable decrease in VAS scores over the 12-week period, reflecting substantial relief in subjective pain perception. Although the On-Field group demonstrated a slightly greater average reduction in VAS scores, this difference was statistically insignificant ($p = 0.6306$), implying that the pain-reducing potential of both rehabilitation modalities is functionally similar. This supports previous literature suggesting that structured, phase-wise rehabilitation, regardless of setting, can yield meaningful reductions in pain for ACL-injured individuals when exercises are progressive, targeted, and adhered to consistently

Similarly, improvements in KOOS scores were observed in both groups, indicating enhancement in knee-related function, mobility, sports participation, and quality of life.

6. CONCLUSION

Clinic-based rehabilitation and on-field training provide similar outcomes after ACL reconstruction. On-field training may expedite safe return to sport.

REFERENCES

[1] Allegrete, J., Batalha, N., Fernandes, O., et al. (2024). Effectiveness of the KC@H Programme Compared with Clinic-Based Rehabilitation After ACL Reconstruction: Study Protocol. BMJ Open Sport & Exercise Medicine. https://doi.org/10.1136/bmjsem-2023-001868

[2] Bafrouei, M. J. (2025). Core-exercise and education post-ACL reconstruction: A pilot RCT. Scientific Reports. https://doi.org/10.1038/s41598-025-13568-1

[3] Edwards, P. K. (2025). Rehabilitation and assessment practices following anterior cruciate ligament: Australian physiotherapists' perspectives.

[4] Erayata, B. N., & Menek, B. (2025). Investigating the effects of percussion massage therapy on ACL recovery: A randomized controlled trial. PLOS ONE, 20(3), e0319731. https://doi.org/10.1371/journal.pone.0319731

[5] Filbay, S. R., Bullock, G., Russell, S., Brown, F., Hui, W., & Egerton, T. (2025). No difference in return-to-sport rate or activity level in people with ACL injury managed with ACL reconstruction or rehabilitation alone: A systematic review and meta-analysis. Sports Medicine. https://doi.org/10.1007/s40279-025-02268-5

[6] Ford, K. R., et al. (2025). Neuromuscular training with real-time biofeedback in female athletes post-ACL reconstruction: A randomized trial. BMC Musculoskeletal Disorders, 26, 366. https://doi.org/10.1186/s12891-025-08647-3

[7] Ghafelzadeh Ahwaz, F. (2025). Feasibility of conducting an RCT comparing surgical and non-surgical options for ACL injuries. Pilot and Feasibility Studies. https://doi.org/10.1186/s40814-025-01652-2

[8] Han, Z. (2025). Club-based vs. hospital-guided rehabilitation after ACL reconstruction. Frontiers in Sports and Active Living. https://doi.org/10.3389/fspor.2025.1641750

[9] High return to competition rate after on-field rehabilitation. (2025). Orthopaedic Journal of Sports Medicine.https://doi.org/10.1177/23259671251320093

[10] Jenkins, S. M. (2022). Rehabilitation after anterior cruciate ligament injury. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC9107547/

[11] Li, Y., et al. (2025). Effectiveness of virtual reality in ACL rehabilitation: A systematic review.https://pubmed.ncbi.nlm.nih.gov/40029868/

[12] Middlebrook, A. (2025). The patient voice—perceptions before and after ACL reconstruction: A qualitative review protocol. Systematic Reviews.

[13] Pamboris, G. M. (2024). Open vs. closed kinetic chain exercises in ACL rehab: A meta-analysis. Frontiers in Sports Science. https://doi.org/10.3389/fspor.2024.1416690

[14] Ricupito, R. (2025). ACL return to play: A framework. Journal of Clinical Medicine.

[15] Smeets, A., et al. (2024). Comparison of delayed surgery vs. conservative treatment after acute ACL injury. BMC Sports Science. https://doi.org/10.1186/s13102-024-00816-6