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Effectiveness of On-Field Training in Anterior Cruciate Ligament (ACL) Injury Rehabilitation

Veer Singh Deora[1], Dr. Farukh Mohammad Pinjara[2], Dr Usman khan[3], Dr. Jafar Khan[4], Dr. Deepak Lohar[5], Dr. Renuka Pal[6], Dr. Hirendra Kumar Katariya[7], Dr. Tina Chouhan[8], Dr. Deepak Sharma[9], Dr. Sujay Gupta[10]

[1]M.P.T. scholar, Pacific college of Physiotherapy, Pacific medical university, Udaipur, Rajasthan

[2]Associate Professor, Pacific college of Physiotherapy, Pacific medical university, Udaipur, Rajasthan

[3]Associate Professor, Department of Orthopedics, Pacific Medical College & Hospital, Pacific Medical University, Udaipur, Rajasthan, India

[4]Dean & HOD, Pacific college of Physiotherapy, Pacific medical university, Udaipur, Rajasthan

[5]Associate Professor, Pacific college of Physiotherapy, Pacific medical university, Udaipur, Rajasthan

[6]Associate Professor, Pacific college of Physiotherapy, Pacific medical university, Udaipur, Rajasthan

[7] Associate Professor, Pacific college of Physiotherapy, Pacific medical university, Udaipur, Rajasthan

[8] Professor & Principal, Udaipur Institute of Physiotherapy, Udaipur, Rajasthan

[9] Consultant Senior Physiotherapist, Saint Terrasa Hospital, Udaipur, Rajasthan, India

[10]Assistant Professor, Department of Orthopedics, Pacific Medical College & Hospital, Pacific Medical University, Udaipur, Rajasthan, India

*** Corresponding Author**

Veer Singh Deora

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ABSTRACT

Anterior cruciate ligament (ACL) injuries are among the most common and debilitating injuries sustained by athletes, often resulting in prolonged time away from sport and significant physical and psychological challenges. Rehabilitation is essential to restore function, prevent re-injury, and optimize return-to-sport readiness. While clinic-based rehabilitation has traditionally been the mainstay of recovery, on-field training has gained recognition as a crucial component in the late stages of rehabilitation. This paper evaluates the effectiveness of on-field training (OFT) in ACL rehabilitation, highlighting its impact on pain reduction, functional improvement, psychological readiness, and return-to-sport outcomes. Findings suggest that OFT accelerates recovery and enhances sport-specific performance without increasing re-injury risk, making it an essential adjunct to clinic-based therapy..

1. INTRODUCTION

Anterior cruciate ligament (ACL) injuries are prevalent in high-impact sports that involve sudden deceleration, pivoting, and cutting maneuvers, such as football, basketball, and skiing. An ACL tear can significantly compromise joint stability, proprioception, and athletic performance. Traditional clinic-based rehabilitation focuses on restoring range of motion, strength, and neuromuscular control in a controlled environment. However, athletes often require additional exposure to sport-specific environments before regaining confidence and functionality. On-field training (OFT) is designed to bridge this gap, reintroducing patients to dynamic, real-world sport conditions in a progressive, structured manner. This study evaluates the effectiveness of OFT in ACL rehabilitation by examining clinical, functional, and psychological outcomes.

2. REVIEW OF LITERATURE

Recent studies emphasize the importance of functional and ecological validity in ACL rehabilitation. On-field training replicates sport-specific conditions, promoting dynamic stability, proprioception, and decision-making under fatigue. Han (2025) reported higher return-to-sport rates in athletes exposed to structured OFT compared with those limited to clinical settings. Stathas (2024) found that OFT accelerated agility, coordination, and biomechanical efficiency. Additionally, Middlebrook (2025) highlighted that OFT enhances psychological readiness and reduces fear of re-injury, a critical determinant of return-to-sport success. These findings underline the growing role of OFT as a necessary phase in ACL

rehabilitation, complementing traditional clinic-based approaches

3. METHODOLOGY

This paper is based on a quasi-experimental design evaluating athletes undergoing ACL rehabilitation. The sample consisted of 20 participants aged 18–30 years, divided into two groups: those receiving clinic-based rehabilitation with OFT integration and those limited to clinic-based rehabilitation only. Interventions lasted 12 weeks, with OFT participants completing field-based agility, plyometric, and sport-specific drills under supervision. Outcome measures included the Visual Analog Scale (VAS) for pain, Knee Injury and Osteoarthritis Outcome Score (KOOS), International Knee Documentation Committee (IKDC) score, hop tests, and the ACL-Return to Sport after Injury (ACL-RSI) psychological readiness scale. Statistical analyses employed paired and independent t-tests to compare pre- and post-intervention scores.

4. RESULTS

Both groups demonstrated significant improvements in pain reduction and functional recovery. However, the OFT group consistently outperformed the clinic-only group. Mean KOOS scores improved to 84.5 in the OFT group compared to 80.2 in the clinic-only group. IKDC scores were higher in the OFT group (87.3 vs 83.1). Hop and agility tests revealed greater limb symmetry and faster performance times in the OFT group. Psychological readiness, as measured by ACL-RSI, was significantly higher among OFT participants, suggesting improved confidence and reduced fear of re-injury.

Table 1: Summary of Age and Gender Distribution

On-Field Training	**Female**	**11**	**25.7**	**20**	**30**
On-Field Training	**Male**	**9**	**26.1**	**21**	**30**

Pre- and Post-VAS Pain Score Summary

Group	Pre-VAS Mean ± SD	Post-VAS Mean ± SD
On-Field Training	8.20 ± 1.40	2.10 ± 1.37

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

Group	Pre-KOOS Mean ± SD	Post-KOOS Mean ± SD
On-Field Training	48.45 ± 7.55	84.80 ± 5.21

5. DISCUSSION

The results highlight the unique benefits of on-field training in bridging the gap between clinical rehabilitation and full return to sport. By replicating real-game scenarios, OFT enhances proprioception, dynamic stability, and confidence, addressing both physical and psychological barriers to return. The slightly superior functional and psychological outcomes suggest that OFT is particularly valuable for athletes with high performance demands. Moreover, the integration of OFT may help reduce re-injury risk by preparing athletes for the unpredictable demands of competitive play. These findings align with previous literature, reinforcing the idea that OFT is not an optional add-on but a critical component of comprehensive ACL rehabilitation.

6. CONCLUSION

On-field training represents an effective and essential component of ACL rehabilitation, particularly for athletes aiming to return to competitive sports. It improves functional outcomes, accelerates psychological readiness, and enhances sport-specific performance compared to clinic-only rehabilitation. Incorporating OFT into late-stage rehabilitation protocols can optimize recovery and reduce re-injury risks, making it a best-practice model for comprehensive ACL injury management.

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