



Effectiveness of neuromuscular stabilisation using staggered deadlift training following ACL reconstruction with meniscus repair: A case report

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Abstract

Anterior Cruciate ligament reconstruction (ACLR) restores mechanical knee stability, yet neuromuscular and dynamic balance deficits often persist, limiting functional recovery. This single-case repeated-measures study evaluated changes in dynamic balance and unilateral functional performance in a patient undergoing phased rehabilitation augmented with a novel hinge-based stabilization exercise. A 31-year-old female underwent right ACLR with lateral meniscus repair and completed a structured rehabilitation program. ACLR rehabilitation protocol was given for 12 weeks which included a novel training of staggered deadlift with isometric holds to target hip-knee neuromuscular control. Outcome were assessed 4 weeks post-operatively and at 12 weeks post-operatively using modified-Star Excursion Balance Test(m-SEBT), single -leg hop for distance, and their limb symmetry indices (LSI). Composite m-SEBT reach on operated limb improved from 58% to 94% of limb length, with LSI improving from 63% to 95%. Single leg hop distance improved from 72 cm to 130 cm, with hop LSI increasing from 57% to 94%. These changes showed restoration of dynamic postural control and unilateral function. The findings suggest that integrating a controlled hinge-based neuromuscular exercise into early-to-mild ACL rehabilitation may contribute to improved sensorimotor control and functional symmetry. Further research is needed to confirm effectiveness in larger cohorts.

Keywords: Staggered dead lift, ACL, ACLR, rehabilitation, physical function, balance, proprioception

Introduction

Anterior Cruciate Ligament (ACL) injury is a common knee pathology associated with persistent functional limitations despite surgical reconstruction. Although ACL Reconstruction (ACLR) restores passive mechanical stability, sensorimotor deficits frequently remain, influencing gait, balance, and unilateral performance.^[1] Deficits in proprioception and neuromuscular control contribute to altered movement strategies, reduced dynamic stability, and delayed return to higher-level activities.^[2] Dynamic balance is a key component of post-ACLR recovery. The modified Star Excursion Balance Test (m-SEBT) is a validated measure of dynamic postural control that challenges lower-limb coordination during single-leg stance^[3]. Reduced reach distances in the operated limb have been associated with neuromuscular impairments and increased injury risk^[4]. Similarly, single leg hop performance reflects unilateral power generation and landing control and is widely used to evaluate functional symmetry^[5]. Limb symmetry indices (LSI) derived from hop tests provide a clinically meaningful indicator of recovery progression and readiness for higher-level activity.^[6]

Rehabilitation following ACLR traditionally emphasizes restoration of range of motion and strengthening; however, neuromuscular retraining is increasingly recognized as essential for restoring sensorimotor function^[7]. Exercises that promote hip-knee coordination under controlled loading may enhance joint stability and improve dynamic balance. Posterior chain activation, particularly through hip-

dominant movement patterns, has been associated with improved lower-limb alignment and reduced valgus stress during functional tasks^[8]. The staggered deadlift, a hinge-based stabilization exercise, may provide such benefits but has not been well documented in ACL rehabilitation literature.

Single-case repeated-measures designs offer a practical method for exploring responses to novel interventions in clinical settings, particularly when preliminary clinical evidence is required^[9]. Therefore, this study aimed to evaluate changes in dynamic balance and unilateral function following phased rehabilitation incorporating a staggered deadlift stabilization exercise after ACL reconstruction.

Conclusion

This single case repeated measures study demonstrated substantial improvements in dynamic balance and functional symmetry following ACL reconstruction when standard rehabilitation was combined with a staggered deadlift stabilization exercise introduced at week 4, m-SEBT and hop LSIs improved from asymmetrical values (63% and 57%) to near normal symmetry (99% each) by six months postoperatively. These findings suggest that targeted neuromuscular stabilization exercises may accelerate restoration of sensory motor control and unilateral function after ACL reconstruction further controlled studies are warranted to confirm these effects in larger populations.

Patient Consent

Written informed consent was obtained from the patient.

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