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Anterior Cruciate Ligament Injury and Pre-Existing Neuromusculoskeletal Dysfunctions: 30 Years of Clinical Observations and Theoretical Correlation with the Kinetic Chain

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Abstract

Anterior cruciate ligament (ACL) injuries are among the most studied musculoskeletal injuries and are traditionally associated with athletic activity. However, long-term clinical physiotherapy experience suggests that a considerable number of ACL injuries occur in non-athletic populations and often follow events described as “accidental”.

The aim of this article is to present 30 years of clinical observations suggesting that pre-existing neuromusculoskeletal dysfunctions—particularly in the lumbar spine—may contribute to knee joint vulnerability prior to ACL injury.

Repeated clinical findings indicated that concurrent therapeutic intervention in the lumbar region was consistently associated with significant reduction in knee pain and improved rehabilitation outcomes following ACL reconstruction.

These observations support the hypothesis that pre-injury neuromusculoskeletal imbalance may play a role in both ACL injury occurrence and recurrence. The purpose of this paper is to stimulate further research regarding the contribution of proximal neuromusculoskeletal factors to ACL injury mechanisms.

Keywords: ACL Injury; Lumbar Spine; Neuromuscular Control; Knee Pain; Kinetic Chain; Physiotherapy

Introduction

Anterior cruciate ligament (ACL) rupture is one of the most frequently studied injuries in sports medicine and orthopaedic rehabilitation. Current literature primarily focuses on injury mechanisms, surgical reconstruction, and return-to-sport protocols.

Modern rehabilitation protocols have evolved significantly and now allow most patients to return to their previous activity levels with high success rates. Despite this progress, several clinical questions remain:

Why do ACL injuries frequently occur in non-athletes?

Why do some injuries occur during low-intensity activities?

Why do recurrences occur despite successful surgery and rehabilitation?

These questions highlight the need to explore potential factors that may precede the injury itself.

Aim of the Paper

The aim of this article is to present an alternative clinical perspective regarding:

the mechanism of ACL injury before the injury event itself.

Clinical Context and Population

Over 30 years of physiotherapy practice:

A substantial increase in ACL injury cases has been observed.

A significant proportion involved non-athletic individuals.

Many injuries occurred during everyday activities.

This experience allowed long-term observation of rehabilitation outcomes across a wide patient population.

Clinical Observations

A recurring finding among patients following ACL reconstruction included:

Persistent knee joint sensitivity.

Prolonged pain.

Symptoms lasting beyond expected recovery timelines.

Although such findings are common post-surgically, their persistent nature prompted further investigation into possible proximal contributing factors.

The Lumbar Spine Hypothesis

Clinical assessment was extended to the lumbar spine and neural distribution to the knee joint.

Repeated observations showed that:

Parallel therapeutic intervention targeting the lumbar region was consistently associated with reduction in knee pain improved rehabilitation progression These outcomes were observed in a large number of cases.

Discussion

These observations suggest the possible presence of:

Pre-existing neuromusculoskeletal dysfunction.

Altered neural distribution to the knee joint.

Reduced mechanical resilience and tissue elasticity.

Loss of functional stability may render the knee vulnerable even under low mechanical loads.

This hypothesis may help explain:

Injuries perceived as “accidental”.

Recurrence after successful surgery.

Prolonged postoperative knee pain.

Theoretical Background and Supporting Literature

Contemporary research increasingly supports the concept that ACL injuries are influenced by the entire kinetic chain rather than the knee joint alone.

Research findings indicate:

Trunk neuromuscular control influences knee loading.

Reduced core stability increases knee valgus stress.

Neuromuscular fatigue alters landing and cutting mechanics.

These findings support the potential involvement of proximal factors in ACL injury mechanisms.

Clinical Implications

If this hypothesis is validated, clinical practice may benefit from:

Lumbar spine assessment in ACL patients. Integration of neuromusculoskeletal screening in prevention programs a more interdisciplinary rehabilitation approach.

Limitations

This article is based on long-term clinical observations and does not constitute a controlled experimental study. Its purpose is hypothesis generation and encouragement of further scientific investigation.

Conclusions

ACL injuries may not be solely the result of an isolated traumatic event. Pre-existing neuromusculoskeletal dysfunctions may create conditions of joint vulnerability prior to injury.

Further research into the role of the lumbar spine and neural distribution in knee function is warranted.

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