From Pelvis to Foot: A Functional Approach to Preventing Ankle Sprains in Athletes

Gabriel Quintero[1,*]

[1]Earthy Center – Chiropractic, Riyadh, Saudi Arabia

Hypothesis Article

Open Access &

Peer-Reviewed Article

DOI:

10.14302/issn.2694-2283.jsem-26-6247

Corresponding author:

Gabriel Quintero, Earthy Center – Chiropractic, Riyadh, Saudi Arabia

Keywords:

sacroiliac joint dysfunction, ankle sprain prevention, kinetic chain biomechanics, pelvic alignment, sports injury risk

Received: April 21, 2026

Accepted: May 20, 2026

Published: June 01, 2026

Academic Editor:

Ian James Martins, Principal Research Fellow, Edith Cowan University

Citation:

Gabriel Quintero (2026) From Pelvis to Foot: A Functional Approach to Preventing Ankle Sprains in Athletes. Journal of Sports and Exercise Medicine - 1(3):11-17. https://doi.org/10.14302/issn.2694-2283.jsem-26-6247

Abstract

Background

Ankle sprains are among the most common injuries in sports, often characterized by high recurrence rates despite appropriate local treatment. Traditional approaches primarily focus on the injured joint, with limited attention to proximal biomechanical factors that may predispose athletes to injury.

Objective

To propose a functional, longitudinal kinetic chain model in which sacroiliac joint dysfunction may act as a predisposing factor for ankle sprain/strain injuries in athletes.

Methods

This paper presents a clinical hypothesis based on biomechanical reasoning and observational findings. The proposed model describes how sacroiliac joint dysfunction, particularly posterior innominate rotation (PI), may lead to pelvic obliquity and functional leg length discrepancy. These changes may induce compensatory femoral external rotation and foot toe-out, altering ground contact mechanics during gait and running.

Results (Hypothesis)

The altered alignment and loading pattern may increase the vertical impact force and modify the ground reaction vector on the functionally shorter limb, resulting in reduced mechanical stability at the ankle during heel strike or foot contact. Over time, this may increase susceptibility to inversion or eversion injuries, manifesting clinically as recurrent sprain/strain.

Conclusion

Ankle sprains in athletes may, in some cases, represent the distal expression of a proximal biomechanical imbalance. Incorporating assessment of the sacroiliac joint and the longitudinal kinetic chain into routine clinical evaluation may improve injury risk identification and contribute to more effective prevention strategies. Further research is needed to investigate this proposed relationship.

Introduction

Ankle sprains are among the most prevalent injuries in sports, accounting for a significant proportion of time lost from training and competition across a wide range of athletic disciplines. Despite advances in acute management, rehabilitation, and return-to-play protocols, recurrence rates remain high [1,2], suggesting that current approaches may not fully address the underlying mechanisms predisposing athletes to injury.

Traditionally, the etiology of ankle sprains has been associated with local factors such as ligamentous laxity, deficits in proprioception, neuromuscular control impairments, and external conditions including playing surfaces and footwear. While these factors are well established and clinically relevant, they primarily focus on the site of injury rather than on potential proximal contributors within the kinetic chain.

In recent years, there has been increasing recognition of the role of proximal biomechanics in influencing distal joint function. Alterations in hip strength, lumbopelvic stability, and lower limb alignment have been shown to affect movement patterns and load distribution during dynamic activities [3,4,5]. However, the potential contribution of sacroiliac joint dysfunction to distal injury risk remains underexplored.

The sacroiliac joint plays a critical role in load transfer between the trunk and the lower extremities [6]. Dysfunction at this level may lead to pelvic obliquity and functional leg length discrepancy, inducing compensatory adaptations along the kinetic chain, including femoral external rotation and altered foot progression angle (toe-out). Such adaptations may influence ground contact mechanics and modify the magnitude and direction of ground reaction forces during gait and athletic movement [7].

From a clinical perspective, these biomechanical alterations may result in less stable foot-ground interaction during initial contact phases, such as heel strike in gait or foot touchdown in running. Over time, this may increase the mechanical demands placed on the ankle joint, particularly in inversion or eversion stress conditions, thereby contributing to the development and recurrence of sprain/strain injuries.

Despite its clinical plausibility, this proximal-to-distal relationship has not been sufficiently investigated in the context of injury prevention. Most current prevention strategies emphasize strengthening, proprioceptive training, and external support at the ankle, with limited attention to the assessment and correction of proximal dysfunctions that may act as predisposing factors.

The purpose of this paper is to propose a functional, longitudinal kinetic chain model in which sacroiliac joint dysfunction may contribute to the development of ankle sprains in athletes. By shifting the focus from isolated joint pathology to integrated biomechanical function, this model aims to provide a conceptual framework for improved clinical assessment and the development of more comprehensive injury prevention strategies.

Proposed Biomechanical Model

The proposed model describes a proximal-to-distal biomechanical pathway in which sacroiliac joint dysfunction may contribute to the development of ankle sprain/strain injuries in athletes. This model is based on clinical observation and biomechanical reasoning, and aims to integrate pelvic alignment, lower limb mechanics, and ground interaction into a unified framework.

These proximal-to-distal adaptations are consistent with current understanding of kinetic chain interactions, where alterations in proximal segments may influence distal joint mechanics and loading patterns [5,3].

Sacroiliac Joint Dysfunction and Pelvic Obliquity

The model begins with sacroiliac joint dysfunction, particularly posterior innominate rotation (PI). This condition may lead to pelvic obliquity and a functional leg length discrepancy, in which the affected limb presents as functionally shorter. Given the sacroiliac joint's role in load transfer between the trunk and lower extremities, such alterations may significantly influence weight distribution and movement patterns.

Compensatory Femoral Rotation and Foot Alignment

In response to pelvic asymmetry, compensatory adaptations may occur along the lower kinetic chain. One of the most relevant is femoral external rotation, which may contribute to an increased foot progression angle (toe-out). This adaptation allows the individual to maintain balance and forward progression, but may alter the mechanical alignment of the limb during dynamic activities.

Altered Ground Contact Mechanics

The presence of toe-out and altered limb alignment may influence the way the foot interacts with the ground during initial contact phases, such as heel strike in gait or foot touchdown in running. Specifically, these changes may modify the orientation of the calcaneus at impact, potentially altering the direction and magnitude of the ground reaction force.

Additionally, pelvic obliquity may result in increased vertical loading on the functionally shorter limb, concentrating impact forces during ground contact. This combination of altered alignment and increased loading may reduce the mechanical stability of the ankle joint at the moment of initial contact.

Distal Amplification at the Ankle–Rearfoot Complex

In addition to proximal adaptations, the altered alignment may be further expressed at the ankle–rearfoot complex. The interaction between the talocrural and subtalar joints may contribute to compensatory external rotation and eversion patterns at the level of the calcaneus. This distal adaptation may accentuate the altered foot progression angle and further compromise the stability of the foot-ground interface during initial contact.

Increased Mechanical Stress and Instability at the Ankle

As a result of these biomechanical changes, the ankle joint may be exposed to less favorable loading conditions, particularly in situations requiring rapid adaptation, such as cutting, landing, or uneven terrain. The altered ground reaction vector, combined with reduced stability, may increase the likelihood of inversion or eversion stress exceeding the tolerance of the ligamentous structures.

Over time, this may manifest clinically as recurrent sprain/strain injuries, particularly in athletes exposed to repetitive high-load activities.

Clinical Expression and Recurrence

From a clinical standpoint, this model suggests that recurrent ankle sprains may not always originate from intrinsic ankle instability alone, but rather from persistent proximal biomechanical imbalances that are not routinely assessed or addressed.

This perspective may help explain why some athletes experience repeated injuries despite appropriate local treatment, and highlights the importance of evaluating the entire longitudinal kinetic chain in both assessment and prevention strategies.

Complementary Pattern: Anterior Innominate Rotation (AS)

While the present model focuses on posterior innominate rotation (PI) as a potential predisposing factor for ankle sprain through toe-out mechanics, the opposite pattern may also have clinical relevance. Anterior innominate rotation (AS) may be associated with functional leg lengthening, internal femoral rotation, and a toe-in gait pattern. Clinically, this presentation is often observed in children and young athletes and may be associated with increased incidence of tripping and falls during dynamic activities.

Although this pattern appears to involve a different injury mechanism, it further supports the concept that alterations in sacroiliac joint biomechanics can influence distal movement patterns and injury risk. Future research is warranted to explore the role of this complementary pattern in sports-related injuries.

Clinical Implications and Injury Prevention

The proposed biomechanical model suggests that ankle sprain/strain injuries may, in some athletes, represent the distal manifestation of proximal dysfunction within the longitudinal kinetic chain. This perspective has important implications for clinical assessment, injury prevention, and long-term athlete management. This expanded approach aligns with the growing emphasis on whole-body assessment in sports medicine and performance optimization [5].

Expanded Clinical Assessment

Traditional evaluation of ankle sprains often focuses on the injured joint, emphasizing ligament integrity, range of motion, and local neuromuscular control. While these elements remain essential, the present model supports the inclusion of a more comprehensive assessment that extends proximally.

Clinicians may consider incorporating:

- Sacroiliac joint evaluation through palpation
- Observation of pelvic alignment and potential obliquity
- Assessment of functional leg length discrepancy
- Analysis of femoral rotation patterns
- Evaluation of foot progression angle (toe-out) during gait and running
- Inspection of footwear wear patterns, particularly lateral heel wear

This broader approach may help identify underlying biomechanical patterns that are not evident when focusing solely on the ankle.

Identification of At-Risk Athletes

One of the most relevant applications of this model is in the early identification of athletes who may be predisposed to injury.

Athletes presenting with:

- Persistent toe-out patterns
- Asymmetrical pelvic mechanics
- Recurrent ankle sprains
- Lateralized wear patterns in footwear

may represent a subgroup in which proximal dysfunction contributes to distal instability.

Recognizing these patterns before injury occurs may provide an opportunity for targeted preventive interventions.

Preventive Strategies

From a preventive standpoint, this model supports a shift from isolated joint management to integrated biomechanical correction.

Potential strategies may include:

- Manual correction of sacroiliac joint dysfunction when clinically indicated
- Restoration of symmetrical pelvic mechanics
- Movement re-education to optimize lower limb alignment during dynamic activities
- Neuromuscular training focused on improving stability across the entire kinetic chain
- Periodic reassessment to monitor changes in alignment and function

Importantly, these interventions are not intended to replace established ankle-focused prevention programs, but rather to complement them by addressing potential upstream contributors.

Implications for Recurrence Reduction

The high recurrence rate of ankle sprains remains a significant challenge in sports medicine. This model provides a potential explanation for why some athletes continue to experience repeated injuries despite appropriate local treatment.

If proximal biomechanical factors remain unaddressed, the underlying conditions that predispose the athlete to injury may persist. Incorporating a longitudinal kinetic chain perspective may therefore contribute to more effective long-term outcomes and reduced recurrence rates.

Integration into Sports Practice

Incorporating this approach into routine sports practice may be feasible in a variety of settings, including clinical environments, team-based care, and athletic screening programs.

Given that palpation-based assessment is time-efficient and can be performed in real time, it may offer a practical tool for ongoing monitoring without the need for imaging or complex instrumentation.

Discussion

Furthermore, the persistence and recurrence of ankle sprains have been widely documented [1], reinforcing the need to explore mechanisms beyond local joint pathology. By integrating pelvic mechanics with distal joint behavior, this model offers a broader framework that may help explain why some athletes continue to experience repeated injuries despite appropriate localized care.

The present paper proposes a functional, longitudinal kinetic chain model in which sacroiliac joint dysfunction may contribute to the development and recurrence of ankle sprain/strain injuries in athletes. This model integrates proximal pelvic mechanics with distal joint behavior, offering a broader perspective on injury etiology beyond the traditionally localized approach.

Current literature supports the role of proximal factors such as hip strength, lumbopelvic stability, and lower limb alignment in influencing distal joint function and injury risk [3,4,5]. The model proposed in this paper extends this concept by suggesting that sacroiliac joint dysfunction may represent an additional, underexplored contributor within this proximal domain.

By linking pelvic obliquity, compensatory femoral rotation, altered foot progression angle, and changes in ground contact mechanics, this framework provides a plausible pathway through which proximal imbalance may be expressed distally.

From a clinical standpoint, this perspective may help explain the persistence and recurrence of ankle sprains in certain athletes despite appropriate local management. If underlying biomechanical asymmetries remain unaddressed, the mechanical conditions predisposing the athlete to injury may persist, increasing the likelihood of repeated events.

At the same time, it is important to acknowledge that ankle sprain/strain injuries are multifactorial. Established contributors such as neuromuscular control deficits, proprioceptive impairment, ligamentous laxity, fatigue, and external factors (e.g., playing surface and footwear) remain highly relevant. The present model does not seek to replace these factors, but rather to complement them by introducing a proximal component that may interact with existing mechanisms.

Limitations

This paper is based on clinical observation and biomechanical reasoning, and therefore should be considered a hypothesis-generating model. The relationships described have not yet been validated through controlled experimental or prospective studies.

Additionally, variability in individual anatomy, movement patterns, and sport-specific demands may influence how these biomechanical factors are expressed. Not all athletes with sacroiliac joint dysfunction will necessarily develop ankle sprains, and not all ankle sprains can be attributed to proximal dysfunction.

Furthermore, the assessment methods discussed, particularly palpation-based evaluation, may be influenced by examiner experience and require appropriate training to ensure consistency.

Recognizing these limitations is essential to appropriately contextualize the proposed model and to guide future research efforts.

Future Directions

Further investigation is warranted to evaluate the validity and clinical applicability of this proposed model. Prospective studies in athletic populations could assess whether the presence of sacroiliac-related asymmetries and associated lower limb adaptations correlates with an increased incidence of ankle sprain/strain injuries.

Future research may also explore:

- The relationship between pelvic obliquity and ground reaction force distribution
- The impact of toe-out mechanics on ankle stability during dynamic activities
- The role of the ankle–rearfoot complex in amplifying proximal biomechanical patterns
- The effectiveness of targeted interventions addressing sacroiliac dysfunction in reducing injury risk and recurrence

In addition, integrating objective biomechanical analysis, such as motion capture or force plate assessment, with clinical evaluation may provide further insight into the mechanisms described.

From a translational perspective, the development of simple, clinically applicable screening protocols based on this model may facilitate early identification of at-risk athletes and support the implementation of preventive strategies in real-world sports settings.

Final Reflection

Understanding ankle sprains as a potential distal expression of proximal dysfunction may represent a meaningful step toward more comprehensive and effective injury prevention in sports.

References

1. Hertel, J. (2002). Functional instability following lateral ankle sprain. *Journal of Athletic Training, 37*(4), 364–375.
2. Fong, D. T., Hong, Y., Chan, L. K., Yung, P. S., & Chan, K. M. (2007). A systematic review on

ankle injury and ankle sprain in sports. *Sports Medicine, 37*(1), 73–94.

3. Powers, C. M. (2010). The influence of abnormal hip mechanics on knee injury. *Journal of Orthopaedic & Sports Physical Therapy, 40*(2), 42–51.
4. Leetun, D. T., Ireland, M. L., Willson, J. D., Ballantyne, B. T., & Davis, I. M. (2004). Core stability measures as risk factors for lower extremity injury in athletes. *Medicine & Science in Sports & Exercise, 36*(6), 926–934.
5. Kibler, W. B., Press, J., & Sciascia, A. (2006). The role of core stability in athletic function. *Sports Medicine, 36*(3), 189–198.
6. Neumann, D. A. (2010). *Kinesiology of the musculoskeletal system*. Mosby.
7. Lieberman, D. E., Venkadesan, M., Werbel, W. A., et al. (2010). Foot strike patterns and collision forces in runners. *Nature, 463*, 531–535.
8. Seffinger, M. A., Najm, W. I., Mishra, S. I., et al. (2004). Reliability of spinal palpation. *Spine, 29* (19), E413–E425.
9. Triano, J. J. (2001). The reliability and validity of chiropractic palpation procedures.