

# The Science and Rehabilitation of Common Running Injuries

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## ABSTRACT

**CONTENT:** Rehabilitation professionals commonly encounter runners who have sustained a running-related injury. Whether or not the health professional has an individual passion for running, it is critical for these clinicians to possess a strong knowledge of running gait and the biomechanical forces that act on the body with each step. These forces combined with the unique qualities of the individual runner and training habits ultimately contribute to subsequent injury. Identifying pertinent risk factors and training load errors is essential in managing and recovering from running-related injury. Clinicians should be well versed in diagnosing and rehabilitating prevalent running-related injuries. This monograph discusses common running-related musculoskeletal injuries including etiology, signs and symptoms, clinical presentation, evidenced-based rehabilitation interventions, and expected outcomes for recovery. The role of kinetic forces and training load errors in contributing to injury is emphasized. The use of gait retraining and progressive resistance training interventions is highlighted. A practical return to run program is provided. **CASE ANALYSES:** Four unique case studies are presented. Each case uses the concepts presented in the monograph. The final case is presented in video format.

**Key Words:** musculoskeletal, overuse, biomechanics, gait retraining

## LEARNING OBJECTIVES

At the conclusion of this monograph, participants will be able to:

1. Define what constitutes a running-related musculoskeletal injury.
2. Identify the prevalence of common running-related injuries among runners.
3. Define the phases of the running gait cycle.
4. Understand the forces acting on the body during each phase of the running gait cycle.
5. Define average and instant vertical loading rates.
6. Define peak braking force and leg stiffness.

7. Define running capacity in relationship to running-related injuries.
8. Describe the life cycle of an injury.
9. Recognize risk factors for running-related injuries.
10. Describe the role that training load error has on running-related injuries.
11. Describe the etiology, signs and symptoms, clinical presentation, diagnostic procedures, evidenced-based rehabilitation interventions, and expected outcomes for recovery for common running-related injuries.
12. Identify two kinetic factors that contribute to patellofemoral pain in runners.
13. Identify two biomechanical contributors to iliotibial band syndrome in runners.
14. Describe the role of loading rates and impact forces in medial tibial stress syndrome.
15. Explain how peak braking forces contribute to Achilles tendinopathy.
16. Recognize therapeutic interventions for plantar fasciitis as described in the Clinical Practice Guidelines from the Academy of Orthopaedic Physical Therapy.
17. Describe 3 key areas of assessment in the rehabilitation of running-related injuries.
18. Describe gait retraining strategies for rehabilitating running-related injuries.
19. Describe the 2 general phases of running-injury rehabilitation.
20. Identify the role of progressive resistance training for rehabilitating running-related injuries.
21. Describe components of a return-to-run program following running-related injury.
22. Identify the role of footwear in rehabilitating running-related injuries.

## INTRODUCTION

It is a well-known fact that runners experience high rates of injury. So much so, that the majority of running research papers begin with a statistic about the high rate of injuries. Unfortunately, the statistics and definitions of running injuries vary widely. It can be time consuming and challenging to stay current on the literature on running-related injuries without understanding what constitutes an injury, and what factors contribute to injuries. The purpose of this monograph is to provide a synthesis of the literature and expertise on running-related musculoskeletal injuries and how rehabilitation professionals treat these injuries.

## RUNNING-RELATED MUSCULOSKELETAL INJURIES

A large variance in the definition of a running-related musculoskeletal injury (RRMI) in the running literature exists due to the multitude of factors used to define a RRMI (Table 1.1). Multiple definitions of RRMI make it challenging to compare studies on the same topic, limiting the ability to form a con-

**Table 1.1.** Factors for Defining Running-Related Injuries

Duration of symptoms	Medical attention received
Severity of symptoms	Effects on performance
Location of symptoms	Associated costs (direct and indirect)

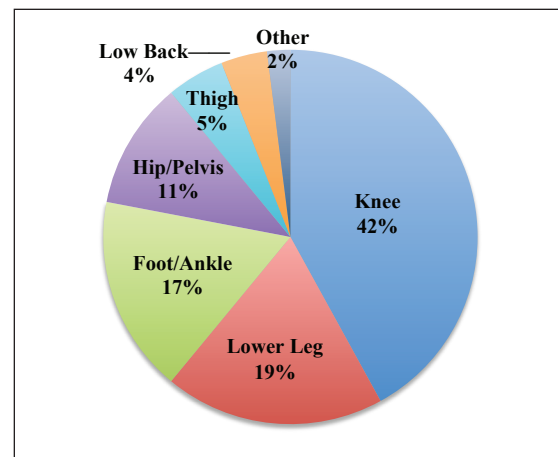
sensus. A systematic review by Yamato et al<sup>1</sup> examined 48 papers to determine the categories used to define RRMIs. Yamato concluded that a consensus is necessary and should include 2 main categories: (1) the presence of physical complaint and (2) a period of interruption.

Yamato later published a definition that was created through a consensus of running researchers who were considered to be the leading experts in the field.<sup>2</sup> The definition was: “Running-related (training or competition) musculoskeletal pain in the lower limbs that causes a restriction on or stoppage of running (distance, speed, duration, or training) for at least 7 days or 3 consecutive scheduled training sessions, or that requires the runner to consult a physician or other health professional.” While not all researchers use or even agree with this statement, the purpose in discussing the definition of a RRMI in this monograph is to give readers a general framework of what a RRMI is and to note that a variety of definitions exist.

## DESCRIPTION OF INJURIES

Injury rates for runners have been reported to be 2.5 to 33 injuries per 1000 hours of running or 19% to 92% of runners sustaining an injury every year.<sup>3-5</sup> Novice runners face a significantly higher risk for injury than their recreational peers.<sup>3</sup> Due to the repetitive nature of running combined with high levels of forces imposed on the body, the majority of injuries are related to overuse.<sup>6</sup>

Rehabilitation professionals treating runners should be familiar with the most frequent types of injuries that occur. The knee is the most commonly injured body part in runners, accounting for 28%<sup>6</sup> to 42%<sup>7</sup> of running injuries (Figure 1.1). Injuries to the lower leg, foot, ankle, and hip all show high rates of injury with ample literature examining the details for each region. Due to the prevalence of injuries by body region, this monograph provides an in depth look at only the most common injuries in runners: patellofemoral pain syndrome, iliotibial band syndrome, medial tibial stress syndrome, Achilles tendinopathy, and plantar fasciitis. Each injury will include a description and etiology of the injury, signs and symptoms, clinical presentation, treatment interventions, and expected outcomes.



**Figure 1.1.** Incidence of running-related injuries by body region.

## RUNNING BIOMECHANICS AND ENERGETICS

To examine specific injuries and effectively communicate among health care providers, rehabilitation professionals should be familiar with the terminology and concepts of kinematics (biomechanical parameters) and kinetics (force parameters). These concepts include phases of the running gait cycle, running mechanics, loading rates, peak braking forces, and leg stiffness. This section defines these terms, which will be used throughout to discuss their role in identification and treatment of running injuries.

Running is a fluid movement incorporating multiple body regions. The phases of running gait (Figure 1.2) efficiently communicate the body position so that each individual body region does not need to be described. Running gait is broken into two main stages, with sub-stages for each. The first stage is stance, which is the period when the foot is in contact with the ground. During the stance phase, the body both absorbs and generates the majority of forces that occur during running. The sub-stages are initial contact (when the foot makes contact with the ground), mid-stance (when the foot is directly below the center of mass), and terminal stance (the last point of contact prior to swing). The second stage is swing, which is the period when the foot becomes airborne and is no longer in contact with the ground. The sub-stages of swing for this monograph will be identified as early swing (when the foot leaves the ground), mid-swing (the halfway point of time between when the foot leaves the ground and makes contact again), and terminal swing (the moment before initial contact). Float is another term used to describe the phase of running when both feet are off the ground. The presence of a float period is what differentiates running from walking.

After understanding the phases of running gait, it is important to understand the forces acting on the body during each phase of running. These forces are referred to as kinetics in the running literature. This monograph will look at average ver-