



## COMMON INJURIES IN MUSICAL THEATER

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### Ankle Sprains

Ankle sprains can occur in musical theater during improper jump landings or when the performer rolls onto the outer aspect of his or her foot.<sup>1</sup> A study published in 2014 found that this mechanism of injury of twisting the foot accounted for 19.6% of injuries in the theater.<sup>2</sup> Ankle sprains are also more likely to occur when the ankle is in plantarflexion, or when the foot is more pointed, due to decreased bony congruency and stability in this position. Contributing factors in musical theater include the use of character shoes and raked stages, both of which place the ankle in a plantarflexed position.<sup>3</sup> Physical therapy can improve muscle strength, proprioception, and landing mechanics to prevent or treat ankle sprains.

### References

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### Achilles Tendon Injury

The Achilles tendon connects the calf muscle to the heel bone, therefore has great importance in movements, such as rising onto demi pointe or pushing off into a jump. Injuries to this structure include tendinitis (inflammation of the tendon from overuse) and ruptures (separation of tendon from its attachment). Mechanisms of injury may include forcing turnout or landing improperly.<sup>1</sup> Contributing factors in musical theater include repetitive stress from performing multiple shows per week, raked stages, and lack of sprung flooring. The incline of a raked stage may cause the calf muscle to become shortened, which can increase injury risk.<sup>2</sup> There is evidence that sprung floors can prevent injury by decreasing the impact of a landing; however, musical theater venues may lack this type of specialized flooring.<sup>3</sup> Physical therapists can help performers recover from Achilles tendon injuries by implementing programs of muscle strengthening, inflammation control, and optimal landing mechanics.

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### **Muscle Spasms & Strains (Most common areas: Lower extremity and Low Back)**

Muscle strains and spasms are commonly reported by musical theater students and professionals.<sup>1,2</sup> The most affected locations include the lower extremities, such as hamstring strains during grand battement, and paraspinal muscle spasms in the low back.<sup>1,3</sup> Common causes of muscle spasms include overuse, muscle imbalance, choreography and positions that demand physical ability and balance.<sup>3</sup> In younger musical theater performers, changes in muscles and connective tissue due to growth can contribute to spasms and strains.<sup>3</sup>

Muscle strains occur when a muscle contracts while lengthening. They are classified into three different categories:<sup>4,5</sup>

1. Grade I (Mild): minor damage to muscle fibers and extracellular matrix
2. Grade II (Moderate): substantial tears to muscle and damage to extracellular matrix
3. Grade III (Severe): complete or near-complete tear across the entire muscle

After a Grade I muscle strain, the patient is expected to make a complete and full recovery. After a moderate or severe muscle strain, the patient may have progressive atrophy of the muscle, development of scar tissue in the extracellular matrix, and subsequent decreases in strength, functional mobility, and athletic ability.<sup>5</sup> Many musical theater performers may sustain mild muscle strains but continue performing through the injury, as dancers have been found to only take time off from performing or to report injuries when the injury becomes more severe.<sup>6</sup> Muscle strains from overuse injuries will often go undiagnosed as performers continue training and performing through injuries.<sup>6</sup>

Muscle spasms are tonic contractions resulting from overuse of a muscle in the absence of muscle injury. The constant contraction can result from increased metabolic activity due to altered nerve activation and often occurs in poorly trained and conditioned muscles.<sup>4</sup> Performers experiencing muscle spasms, specifically in the low back, are expected to return to normal function after 4 to 6 weeks. However, muscle spasms can recur if the performer does not address contributing factors, such as muscle weakness and motor control deficits.<sup>3</sup>

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### **Lumbar Spine: Facet Joint Arthropathy, Instability & Spondylolysis**

While the majority of research focuses on low back injuries in ballet and contemporary dancers, surveys have shown that musical theater students and professionals do report low back pain.<sup>1,2</sup> About 73% of dancers will experience at least one episode of low back pain per year.<sup>3</sup> General reports of low back pain in musical theatre students include muscle spasms and joint pain.<sup>1</sup>

Facet joint arthropathy can occur acutely due to an incident resulting in excessive closing or opening of the facet joint in the lumbar spine. Repetitive compression microtrauma to the joint can also lead to inflammatory and mechanical changes at the facet joint that contribute to symptoms.<sup>5</sup> Patients may report a “locking” sensation that further inhibits their movement, often due to hypermobility in the lumbar spine. Other aggravating movements may include axial rotation, a combination of axial rotation and extension, weightbearing, jumping, and lower extremity abduction.<sup>4,6</sup> For the musical theater performer presenting with facet arthropathy, healthcare professionals should always screen for vertebral instability and/or fracture, especially if the patient experienced a traumatic injury.

Spondylolysis can occur from a single acute trauma involving lumbar hyperextension or due to excessive or repetitive hyperextension activities. In spondylolisthesis, the vertebral body is displaced anteriorly relative to adjacent vertebral bodies.<sup>7</sup> Microtrauma from repetitive extension activity can cause damage to the pars interarticularis. If microtrauma exceeds the ability of the bone to repair itself, a fracture may result, and anterior displacement can occur.<sup>7</sup> Spondylolysis is typically asymptomatic and exists on a continuum of instability that results from deficits in structural stability, muscle activation, and motor control.<sup>8</sup> Similar to those with facet joint arthropathy, musical theater students and professionals may present with reports of pain during movements that involve extension, trunk rotation, jumping, and hip abduction and external rotation.

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### **Concussion**

In addition to injuries from performance demands, musical theater performers are also exposed to exogenous injury risk factors, such as set components, backstage hazards, and fly harnesses. Performers may experience concussion injuries following collision with a stage prop, a fall while performing partner work, navigating a set, or flying in a harness.

In 2012, the 4<sup>th</sup> International Conference on Concussion in Sport defined concussion as “a brain injury...defined as a complex pathophysiological process affecting the brain, induced by biomechanical forces.”<sup>1</sup> Concussions are a mild traumatic brain injury (MTBI) on the less severe end of the brain injury spectrum.<sup>2</sup> While a concussion is considered a MTBI, not all MTBIs are considered concussions.<sup>2</sup> A concussion occurs following a head injury that causes linear and/or rotational forces to disrupt neural pathways in the brain. Afterwards, a “neurometabolic cascade” occurs, in which altered nutrient and oxygen demands, increased metabolic processes, and decreased blood flow contribute to decreased neural function. In addition, biomechanical changes in neural structures disrupt neuronal function and communication.<sup>3</sup>

Patient presentation following concussive events varies. Patients typically experience rapid onset of short-lived neurologic deficits; however, these symptoms can last anywhere from a few minutes to several hours.<sup>1</sup> When patients receive neuroimaging following the injury, results are often negative, as acute symptoms are mostly attributed to functional rather than structural disturbances.<sup>1</sup> The Post-Concussion Symptom Scale is an outcome measure used to determine the severity of 22 common symptoms (scale of 0 – 6, with 0 being no symptoms and 6 being severe symptoms) and can be used to track a patient’s recovery.<sup>4</sup> Balance measures are also used since balance is often affected by concussion.<sup>4</sup> Patient report of symptoms may include headache, difficulty with cognitive tasks, difficulty getting up in the morning, and increase in symptoms during activity (e.g. feeling disoriented, fatigue).<sup>4</sup> The reported incidence of concussion in performers is low. However, this may be attributed to decreased awareness of symptoms and/or addressing other injuries that occur at the time of the concussion.<sup>4</sup>

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