Literature Review

“Hamstring Strain Injuries: Incidence, Mechanisms, Risk Factors, and Training Recommendations” by Chris Wing and Chris Bishop:

Source: https://journals.lww.com/nsca-scj/fulltext/2020/06000/hamstring_strain_injuries__incidence,_mechanisms,.5.aspx

Hamstring injuries are the most common injury in many different sports and can have very significant effects on the athletes and clubs as players deal with injuries. High stakes related to this injury include players losing significant amounts of playing time, which can lead to overall negative effects on team performance, along with potential financial losses as well. This is a multifaceted issue with a need for attention on the risk factors and severity of hamstring injuries, as recovery can take upward of twenty-eight days. These injuries can be categorized based on how the injury occurred into acute, overuse, or chronic, also known as recurrent. An acute hamstring injury describes an injury sustained on impact, while overuse injuries are the result of high strain over a larger span of time. Chronic and recurrent injuries simply describe hamstring injuries that result from the impact of a previous injury on the muscle. The severity, on the other hand, is denoted by types I, II, and III where a type I hamstring strain is a very small injury, type II has a larger impacted area, and type III is a complete tear. These different severities have different prevalence in sports, with type I strains being primarily associated with sprinting injuries, which have more ties to sports like football and soccer. Type II strains, however, are more common in dancers as the injury results from excessive stretching. With increased severity of the injury, the time the athlete must take off increases. As our focus is in the realm of football, we will mainly focus on type I strains as they are the most prevalent.

There are many signs within each athlete that can point towards these hamstring injuries, which include modifiable and non-modifiable risk factors. Modifiable risk factors are risk factors that can be changed through specific training and include factors such as fatigue, symmetry between right and left muscles, overexposure or underexposure to high-speed sprints, and strength. Eccentric strength with the use of the Nordic has been the primary focus of most HSI research, which has been somewhat effective, but the other modifiable factors are important as well to consider to help better prevent hamstring injuries. Fatigue makes muscles less effective and more prone to injury; therefore, many hamstring injuries occur towards the end of games, along with players being more prone to injury in game scenarios versus training. Asymmetry also leads to injury. Symmetry is broken down into interlimb and intralimb, describing the imbalance between left and right legs and between the quadriceps and hamstrings in the same leg, respectively. For the focus of HSI, only the strength between different limbs is helpful to look at. The non-modifiable risk factors for HSI are risk factors out of the control of the athlete and include previous injuries and the age of the athlete. Research shows that previous injuries of the hamstrings increase the risk of sustaining another injury, and an increase in age typically also increases the risk of HSI, while this could be biased by a general increase in body weight and decrease in strength, as well as age increases. It is also important to note that the reason hamstring injuries are so common is that the hamstring

stretches at two points, making it easier to injure with more than one vulnerable spot on the muscle.

“Risk and Prognosis of Hamstring Injuries in the National Football League: A 12-Year Review” by Ryne Jenkins, John Bianchi, Jeremy Watson, Jason Shinners, Pooja Jaisinghani, Brett Spain, and Charles Ruotolo:

Source: https://pmc.ncbi.nlm.nih.gov/articles/PMC11624564/

The National Football League had a twelve-year review done on the risk and prognosis of hamstring injuries. It was seen that a fourth of players suffered from some kind of lower-body strain in their career. In that 55% of those were hamstring injuries. Risk factors for a hamstring injury are seen as the same, including strength imbalance, flexibility, and player fatigue, as modifiable components. The biggest risk factor being, again, previous injury, as in the study of the total n players, about 33% got reinjured. Positions played a major role in the likelihood of injury as well. As defensive players were most frequently injured, making up about 50% of the players who injured their hamstrings. Defensive players are made up of safeties, cornerbacks, and linebackers. Linebackers are the most likely to be injured among the defensive players. These results could indicate a strong influence of position being casual to hamstring injury but it is also important to keep in mind this number could be a bit skewed to the number of players for each position on the field at a time. As there is only one quarterback, there may be as many as four linebackers and five wide receivers on the field.

“Risk factors for hamstring strain injury in male college American football players -a preliminary prospective cohort study-” by Yuri Mizutani, Shuji Taketomi, Kohei Kawaguchi, Seira Takei, Ryota Yamagami, Kenichi Kono, Tomofumi Kage, Shin Sameshima, Hiroshi Inui, Sayaka Fujiwara, Sakae Tanaka, and Toru Ogata:

Source: https://pmc.ncbi.nlm.nih.gov/articles/PMC10236836/

A study was done on risk factors for hamstring strain injury in male college American football players in 78 skill position players by the University of Tokyo Sports Science Initiative (UTSSI) Sport Injury Prevention Project. HSIs have mostly been caused by noncontact incidents and occur while running for American football players. It is important to recognize that no true preventative measure has been achieved to prevent these injuries. About 32% of these players had a HSI. It was recognized that the injured players had significantly lower hamstring flexibility and hamstring-to-quad strength ratio. (risk factors) . Statistically significant risk factors determined were lower hamstring muscle flexibility (degree), lower hamstring to quadriceps strength ratio, and lower general joint laxity of the elbow and hip. It is worth noting that this was an extremely small study made up of only skill players from one team, and therefore it is hard to draw any major conclusions that can be generalized across the board to other teams and/or sports.

“Limited Return to Preinjury Performance in NCAA Division I American Football Players With Hamstring Injuries” by William M Hannay, Joseph M Sliepka, Kate Parker, Kyle Sammons, Albert O Gee, Christopher Y Kweon, Mia S Hagen:

Source: https://pmc.ncbi.nlm.nih.gov/articles/PMC11070146/

In this study there were 58 hamstring injuries in 44 players but only 25 of these injuries in 20 players were used as they had GNSS/LPS data while the others did not. Catapult Sports was used to obtain this GNSS/LPS data during practices and games for the selected players. One measure used through this software was player load, which references the instantaneous rate of change in the acceleration of the player divided by some scaling factor. In each case of these 25 injuries, the player returned to play with an average of 9.2 days for recovery. However, in only 16% of these cases, after an average of 425 days, was the athlete able to perform at the preinjury ability in all of the measurements. The most impacted ability was the athletes ability to run at constant high speeds. All of the athletic abilities showed statistically significant differences between the injured state and pre-injury state. While athletes typically returned relatively quickly to be able to play, their peak performance was significantly impacted for long periods of time. The author suggests that maximal velocity could be an important variable in deciding when a player is ready to return to the sport. The limitations of this study are that only a very small sample of 25 injuries were analyzed which limits the conclusions that can be drawn from it. Also, there are confounding variables that could have impacted the player’s ability to return to their peak performance such as other injuries.

“A Field-Based Approach to Determine Soft Tissue Injury Risk in Elite Futsal Using Novel Machine Learning Techniques” Iñaki Ruiz-Peréz, Alejandro López-Valenciano, Sergio Hernández-Sánchez, José M. Puerta-Callejón, Mark De Ste Croix, Pilar Sainz de Baranda, and Francisco Ayala:

Source:
https://www.frontiersin.org/journals/psychology/articles/10.3389/fpsyg.2021.610210/full

A study went into lower extremity non-contact soft tissue (LE-ST) injuries, which are very prevalent in football (soccer). 139 soccer players went through a screening process during preseason, evaluating a multitude of metrics and characteristics. Thus, these measures were used to predict LE-ST injuries after utilizing a wide range of supervised Machine Learning techniques. The model reported the best prediction performance scores. AUC = 0.767, true positive rate = 65.9% and true negative rate = 62%. Concluded moderate accuracy for identifying soccer players at risk of LE-ST injury.