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Review of Risk Factors Associated with the Development of Iliotibial Band Syndrome in Runners

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ABSTRACT

Review of Risk Factors Associated with the Development of Iliotibial Band Syndrome in Runners

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Iliotibial band syndrome (ITBS) is one of the most common injuries among long distance runners of all skill levels. ITBS is a painful and somewhat debilitating injury designated by pain of the Iliotibial band (ITB) which occurs on the lateral side of the knee. The pain associated with ITBS can not only affect running, but also everyday activities. While ITBS is typically an overuse injury, there can be many factors that play a role. This review outlines various anatomical factors, training factors, environmental factors, running form factors, footwear factors, and physiological factors that play a role in the causation of ITBS. By compiling information pertaining to the causation and prevention of ITBS, this paper provides an in-depth review of the literature to better understand what factors can lead to ITBS, and what can be done to prevent it from becoming an issue in the first place. The goal of this review paper is to address the occurrence of ITBS in long distance runners by providing an evidence-based collection of risk factors intended to increase awareness of relevant risk factors and offer preventative measures for runners to reduce the likelihood of developing IT band syndrome.

Keywords: IT Band Syndrome, Risk Factors, Runners

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CHAPTER ONE

Introduction

Running is a popular activity worldwide. Millions of runners can be found with all sorts of reasons for running, from reaching fitness goals to achieving high levels of performance to just having fun. No matter what level of dedication to running an individual has, injuries are always a possibility. One of the most common running injuries is Iliotibial Band Syndrome (ITBS).

The Iliotibial Band (ITB) is a band of fibers stemming from the tendinous portion of the tensor fascia lata muscle on the lateral portion of the leg as well as from the gluteal muscles. The ITB is attached to the linea aspera for most of the length of the femur until just proximal to the lateral epicondyle. The ITB has several distal insertion points at the lateral retinaculum, the lateral border of the patella, and on Gerdy's tubercle on the tibia (Fredericson & Wolf, 2005).

The ITB functions as a lateral stabilizer through the leg (MacMahon, Chaudhari, & Andriacchi, 2000). Statically, the ITB helps maintain hip extension around the greater trochanter and helps maintain knee extension at the distal end (Lucas, 1992). When running, however, the role of the ITB shifts with the tensor fascia latae to maintain hip flexion, and when the knee is flexed past 30°, the ITB helps to maintain knee flexion as well (Lucas, 1992).

Iliotibial band syndrome is a painful irritation of the ITB as a result of repeated impingement of the ITB with the lateral femoral epicondyle at roughly 30° of knee flexion (Fredericson & Wolf, 2005). The irritation can lead to the ITB becoming inflamed, and if the irritation continues, ITBS can become a chronic condition (Fredericson & Wolf, 2005). ITBS is most commonly found in runners due to the repetitive nature of distance running and the time spent with the knee at 30° of flexion (Fredericson & Wolf, 2005).

When the ITB becomes irritated as a result of one or several factors influencing the development of ITBS, the pain tends to be localized to the lateral knee (Fredericson & Wolf, 2005). With the inflammation of the ITB, sharp pain is often felt when the knee is flexed around 30°, the point at which the ITB and lateral femoral epicondyle are at maximal contact (Fredericson & Wolf, 2005). The pain associated with ITBS often only occurs after performing repetitive movements that involve the knee being flexed and extended past 30° of flexion for a certain amount of time, such as running (Fredericson & Wolf, 2005). In cases where the inflammation is more severe, pain may be present even at times when the individual is not running. In these severe cases, pain may come from knee flexion that is not necessarily at or near 30°, including walking up or down stairs, sitting with the knees in flexion, and in the most severe cases, even walking (Fredericson & Wolf, 2005).

In individuals with ITBS, runs often start pain free with the pain coming on after running a short distance. Two to three centimeters proximal to the joint line in the lateral knee may be tender to touch and sometimes swollen as fluid builds up (Fredericson & Wolf, 2005). With flexion and extension of the knee, crepitation and snapping sounds may occur as the ITB crosses the zone of impingement with the lateral femoral epicondyle (Fredericson & Wolf, 2005).

One particular area of debate regarding ITBS is whether the syndrome is a friction syndrome or not. ITBS is frequently described as iliotibial band friction syndrome, with the friction coming from the ITB sliding past the lateral femoral epicondyle and rubbing, causing friction that leads to irritation and inflammation (Lavine, 2010). The contrasting belief is that the pain from ITBS is due to the compression of a layer of densely innervated fat between the ITB and lateral femoral epicondyle (Fairclough et al., 2006). As the knee is flexed to 30°, the ITB tenses and shifts medially toward the femur, compressing the layer of fat and causing pain signals to be elicited (Fairclough et al., 2006).

Despite there being two theories of ITBS, both involve impingement of the ITB and lateral femoral epicondyle at 30° of knee flexion. Whether the ITB is irritated as a result of friction or compression is a topic that should merit further research given the prevalence of the syndrome. Regarding the risk factors for developing ITBS, the important part is that the ITB fibers are irritated by some sort of impingement with the lateral femoral epicondyle. By either definition, the result of the impingement is irritation, inflammation, and pain.

ITBS has a high prevalence in the running community and is the number one cause of lateral knee pain in runners, accounting for as much as 12% of overuse injuries for runners (Fredericson & Wolf, 2005). ITBS is the second most common overuse running injury behind Patella Femoral Pain Syndrome (Taunton et al., 2002). With running as one of the most popular physical activities around the world, the high rate of

ITB injury is significant. ITBS is an injury that can afflict runners of all skill levels, from beginners to ultramarathoners, with experienced runners often encountering worse symptoms due to their extremely high training volume (Noble, 1979).

Risk factors for the development of ITBS can manifest in all sorts of ways: From the anatomy of one’s body, the way one trains, interactions with the environment, running mechanics, footwear, and various physiological triggers. Many runners could be at risk for developing ITBS and not be aware that they could be heading toward a problem. Identifying which risk factors are relevant and making adjustments can help reduce the chances of developing ITBS.

CHAPTER TWO

Anatomical Risk Factors

Anatomical variations can be risk factors for ITBS. While less can be done to prevent ITBS due to certain anatomical factors, it is important to be aware of all potential areas of risk.

As ITBS is typically described as a friction syndrome from the ITB rubbing the lateral femoral epicondyle, anatomical variations in the area of the injury can play a large role. Varus knee alignment was found in 33% of runners with ITBS in a study of running injuries by Taunton et al (2002). With the knees bowing outward in knee varus, the lateral femoral epicondyle would appear more pronounced on the lateral side of the knee joint, increasing the likelihood of friction from the ITB. In a similar manner to knee varus, a prominent lateral femoral epicondyle will lead to a greater chance of friction between the ITB and epicondyle (Fredericson & Wolf, 2005). On the other side of the anatomy of ITB impingement is the ITB itself. A naturally tight ITB increases compression against the lateral femoral epicondyle and makes the development of ITBS a greater possibility (Lucas, 1992).

Differences in leg length is another anatomical anomaly that can contribute to ITBS (Fredericson & Wolf, 2005). These differences can occur naturally or can occur as a result of running on a sloped surface over a long period of time (Fredericson & Wolf, 2005). A leg length discrepancy is found in around 10% of ITBS cases (Taunton et al., 2002). The length difference causes an imbalance that one side must compensate for, putting more strain on the ITB. A heel lift or a similar shoe insert can help correct the imbalance of differing leg lengths (Fredericson & Wolf, 2005).

Several anatomical abnormalities throughout the leg can also cause issues that could end up affecting the ITB. Pes planus, or flat feet, is a common cause of pronation that can increase internal rotation of the leg, which places the ITB at a position where it is more likely to rub against the lateral femoral epicondyle (Fredericson & Wolf, 2005). In Taunton et al's study of running injuries, 15% of runners with ITBS had pes planus (2002). Forefoot varus and metatarsus adductus can also cause pronation from the ankle, putting the ITB under tension similarly to pes planus (Fredericson & Wolf, 2005). Internal femoral torsion and internal tibial torsion are other deformities that can alter the mechanics of the leg to negatively affect the ITB through increased internal rotation moment and adductor moment, especially for individuals with weak abductors and external rotators in the hips (Fredericson & Wolf, 2005).

In younger populations, a growth spurt can be a risk factor for ITBS (Gose & Schweizer, 1989). During a growth spurt, bone tissues may grow faster than some of the soft tissues, such as the ITB, increasing the tightness of the soft tissues (Gose & Schweizer, 1989). With a tighter ITB, the contact between the ITB and the lateral femoral epicondyle would increase along with the chances of developing ITBS. Younger populations are often involved in athletics, including running, making a combination of a tight ITB due to a growth spurt and other risk factors even more likely.

Previous injuries, if not properly rehabbed and, more importantly, had the suspected causes addressed, can be risk factors for future injuries (Fields, Sykes, Walker & Jackson, 2010). Assuming the cause was not due to a single random circumstance, the underlying deficiencies, whether it is training error, musculoskeletal deficiencies, biomechanical faults or another source, need to be addressed to limit the chance of reinjury or an injury caused by some form of compensation for the deficiency.

If there is a way to address inherent anatomical abnormalities related to ITBS, those steps should be taken to help avoid compounding risk factors. Anatomical risk factors are far from the most common factors for developing ITBS, but since many anatomical factors are difficult to correct, other potential risk factors are likely to exacerbate problems and make ITBS even more likely.

CHAPTER THREE

Training Risk Factors

As ITBS is often characterized as an overuse injury, the way one trains can play a large role in the development of the syndrome. As much as 60% of running injuries can be directly traced back to errors in training (Fields et al., 2010). When examining distance running, training volume, intensity, consistency, and recovery are all important aspects to consider regarding training effectiveness for performance and fitness. Those same components should be looked at when identifying risks for ITBS in distance running training.

For runners who create their own training plans, adjustments to how one trains can counter many of the potential ITBS risk factors, assuming the individual is aware of relevant risk factors. Runners who follow a plan created by a coach, either for that individual personally or as part of a team, should communicate any pain to their coach and be mindful of the risk factors within their control.

The most important training factor to consider when assessing risk of developing ITBS would likely be training volume. Due to ITBS being primarily an overuse injury, sharply increasing running distance is a common trigger to developing the syndrome. The injury risk from distance can come from a single, abnormally long run or a large increase in distance from week to week (Noble, 1979). Generally, running volume should increase by no more than 10% from one week to the next, and surpassing that percentage increases the risk of injury (Sallade & Koch, 1992). When exposed to a training stimulus, tissues break down, requiring time to build back up (Vigil, 1995). When more stimulus is added before the body has had the chance to rest and compensate for the previous stimulus, the fatigue in the tissues can become worse and performance and form can suffer as a result of overtraining (Vigil, 1995).

Training volume may be the main factor for developing ITBS, but it is not the only training error. Sudden fluctuations in the amount or intensity of speed workouts put the ITB at a greater risk of injury with the increased fatigue in the lower extremities from the faster pace (Gose & Schweizer, 1989). Adding in hill workouts without giving the body time to gradually build up to the different muscular demands of running up and down hills also puts the ITB at risk (Gose & Schweizer, 1989).

Running slowly can be a factor in developing ITBS. Running at a slow pace reduces the angle of flexion at foot strike, which in combination with simply not moving as quickly, increases the duration that the ITB and lateral femoral epicondyle are at maximal impingement (Strauss, Calcei, & Park, 2011). This is important to note because many running injuries are thought to be a consequence of running too quickly (Hreljac, 2004). Sprinting generally causes no issue for individuals with ITBS (Gose & Schweizer, 1989).

A major part of injury prevention is a well-developed training plan that utilizes the strategy of periodization. Periodization is a deliberate and organized plan for training that progresses through a certain time period, often culminating in a window of peak performance (Vigil, 1995). The overall training plan is split into different cycles of progressively shorter length and greater specificity: Macrocycle to mesocycle to microcycle (Vigil, 1995). The shortest cycle, the microcycle, is typically one to two weeks in length with specific workouts of varying intensities and durations to meet the predetermined focus of the day: Endurance, speed, form, or other main goals of the training plan (Vigil, 1995). The workouts within the microcycle should be a carefully chosen group of exercises and recovery tailored to an individual's level of fitness and overall condition (Vigil, 1995). While it is important to plan workouts ahead of time when creating a training plan, there should be flexibility in planning in case the runner is feeling overly fatigued or sick (Sallade & Koch, 1992). A balance between the volume and intensity of workouts must be found to prevent overtraining and reduce injury risk within the microcycle (Vigil, 1995). The mesocycle is usually four to eight weeks in length, which is enough time to see improvements in running mechanics, running economy, aerobic capacity, and anaerobic threshold as a result of the training and recovery contained in the workouts from the microcycles (Vigil, 1995). The goals of training adaptations for each mesocycle progress depending on where in the overall macrocycle a runner is at that time. Typically, the further from the time where a runner hopes to peak, the more volume the training will include (Vigil, 1995). As a runner progresses through mesocycles, the volume will decrease as the intensity of the workouts increases until the peak is reached (Vigil, 1995). The macrocycle is the overarching timeline from the start to the planned peak, usually lasting a year or less, but can be as long as four years (Vigil, 1995).

While periodization is often thought of in the context of sport performance, the deliberate steps of planning each workout and specifying rest help avoid many training errors that can result in injury. The effects of periodized training can optimize the functioning of tissues. Properly planned and executed periodization often leads to progressively improved performance with reduced injury risk as a consequence of the improved condition, running economy, and proper recovery (Vigil, 1995).

A properly developed and well thought out training program for distance running can drastically lower the risk of developing ITBS. Being mindful of progressions in distance, speed and corresponding rest is essential. If there is no way to avoid one of the training risk factors in a particular area or at a certain time, finding an alternative activity or exercising caution and listening to one's body for any potential problems is a must. While training factors happen to be the most common cause for ITBS, they are also typically the easiest problems to solve, often only requiring modifications to the training plan. So, if training is programmed and executed correctly, the chances of developing ITBS can be lowered.

CHAPTER FOUR

Environmental Risk Factors

Running is not contained to the confines of the body. The environment in which the running takes place can have great effects on how an individual is able to run. Injury risk can go up or down depending on the environment of the training.

The type of surface used for running can have an effect on the ITB. In a similar manner to fatigued muscles not absorbing impact to protect the ITB, running downhill can place stress on the ITB. Running down a gradient means that, if no adjustments are made to one's stride, the foot will strike down further and cause the leg to function eccentrically for a long period, putting more stress on the tissues throughout the lower extremities (Sallade & Koch, 1992). If the muscles are too fatigued to compensate, the ITB is put at risk of irritation and injury. Another consideration for running downhill is the angle of knee flexion when the foot lands. Landing on a downhill slope decreases the amount of knee flexion, which causes an increase in the time that the ITB is in the impingement zone with the lateral femoral epicondyle (Strauss et al., 2011).

Frequent training on a track without changing direction can increase the chances of developing ITBS. While the effect may by small, the inside foot pronates at a greater rate than usual (Sallade & Koch, 1992). With repeated training sessions on a track without changing directions, the cumulative effects of over-pronating on one foot can put the ITB at a greater risk for developing ITBS as well as other injuries (Sallade & Koch, 1992).

In addition to same-direction running on a track, running on the same side of roads can contribute to the risk of ITBS for similar reasons (Fredericson & Wolf, 2005). Most roads are engineered with the center higher up than the sides (Sallade & Koch, 1992). The crowned surface of roads combined with the recommendation that runners should run against traffic creates a scenario of increased risk for ITBS (Sallade & Koch, 1992). This slight angle on the road's surface means that the leg closer to the inside of the road lands higher than the outside leg, putting more strain on the inside leg, causing a muscular imbalance and creating a leg length discrepancy (Noble, 1979). The crest of the road also puts the outside leg at greater risk because the knee is more likely to land in a varus position, increasing the impingement between the ITB and lateral femoral epicondyle (Gose & Schweizer, 1989). Based on the nature of distance running, training will often include running for long periods of time on roads, sometimes hours on end. If no alternative paths are utilized or are unavailable, the time spent with an artificial leg length discrepancy and uneven strain due to the slope of the road can add up and increase the chances of developing ITBS.

While frequent running downhills, in one direction on a track, or on a cambered road can increase the risk for ITBS, quickly switching between running surface types (pavement, grass, dirt) can also be a risk factor (Lucas, 1992). As is often the case, gradual changes to the environment are preferable to stark differences to allow the body time to adjust.

In a study by Orava, slippery road conditions and cold weather were other environmental factors believed to contribute to the development of ITBS (Orava, 1978). Cold weather decreases muscle speed, power, and coordination, all important factors for reacting to the environment and avoiding injury while running (Vigil, 1995). In Orava's study, the majority of its participants were injured during the cold winter months when road conditions were poor (Orava, 1978). The lack of stable footing could potentially increase fatigue and the need for extra stabilization in which the ITB could be at greater risk for injury due to its role as a stabilizer. Without an adequate warmup or proper clothing, cold weather can cause muscles to be tight, not allowing muscles to perform as well as normal or in a full range of motion (Vigil, 1995).

Running surface might be a difficult factor to change for some runners. Depending on the area and circumstances, roads may be the only viable option, winters can create hazardous conditions, and track running may be a training requirement. Instead of avoiding cambered roads, tracks, and hills, trying to mix up the surface types without sudden changes can reduce the repetitive stresses from the different surface types. Being mindful of the type of surface one typically runs on and how to counter each surface types' effects is likely all it would take to limit this risk factor for ITBS. Planning routes ahead of time and staying aware of the ground underfoot at all times when running are also important in reducing the risk of injury.

CHAPTER FIVE

Running Form Risk Factors

Much like most other forms of exercise, proper form while running is a key consideration to preventing injuries, and ITBS is no exception to that rule. Since running is such a natural activity, little thought is often given to the intricacies of running form. Often nothing comes of the ignorance, but sometimes the act that seems second nature can be part of the problem.

Proper running form has many pieces. The head, trunk, and pelvis should remain in a neutral position throughout, and the foot should strike directly underneath the center of mass with a stable, dorsiflexed ankle (Freeman, 2015). Movement at the head, twisting of the upper body, and excessive or inadequate arm movement are all inefficient but common form errors in runners (Vigil, 1995). Maintaining ideal running form over long distances requires strong core muscles, leg muscles, and sufficient flexibility (Vigil, 1995).

One key to reducing the chance of injury is to lessen the amount of shock the ITB must absorb. The primary source of shock while running is during the landing phase when the foot strikes the ground. The force from striking the ground while running can reach up to five times one's body weight (Rothschild, 2012). If the heel strikes the ground first, more shock is sent up to the body from the ground reaction force because the foot is not utilized as a shock absorber as it is when the midfoot is the point of contact during foot strike (Heiderscheidt, Chumanov, Michalski, Willie, & Ryan, 2012). When running at a moderate pace or slower on a flat surface, the majority of runners exhibit a heel strike running pattern (Hreljac, 2004). With such a high rate of heel striking among runners, footstrike should be a primary consideration when evaluating relevant risk factors for ITBS.

Over-striding is another risk factor related to running form. Over-striding is when the foot strikes forward of the knee instead of underneath it. This style of running will most likely result in a heel strike. Stride length is often associated with a low cadence. A study from Heiderscheidt et al found that by increasing cadence while running by just 5% reduces the energy absorbed at the knee by 20%, and a 10% increase in cadence corresponds to a 34% decrease (2012). This change in energy absorption is caused by the corresponding reduction in stride length with the higher cadence (Heiderscheidt et al., 2012). There is also a reduction in the energy absorption at the hip and ankle joints, which also have a role in preventing ITBS, but the knee benefits the most from the cadence and is the most important regarding ITBS (Heiderscheidt et al., 2012). Other strategies for countering over-striding include increasing knee lift and push off, echoing sprinting mechanics (Freeman, 2015). Reducing stride length also helps correct the problem of heel-striking in some runners by forcing the foot to land more closely to the body. A change to one's cadence can also help correct some internal rotation and adduction at the hips, both of which put the ITB in a position of impingement (Heiderscheidt et al., 2012).

Form is one of the most important aspects of running because of its wide-ranging effects. Not only does proper running form reduce the risk of injury, proper form improves running economy as well. The improvement to running economy allows a runner to run longer and often faster while expending the same effort as before (Vigil, 1995). Regarding injury risk, the improved running economy from proper form leads to lower levels of fatigue when running the same distance (Vigil, 1995). By optimizing form to reduce fatigue, the overall load on the body is lower, allowing for improved recovery to reduce injury risk (Vigil,1995).

While making adjustments to running form has the potential to reduce the risk of developing ITBS, care should be taken. The body is used to running a certain way and changing that could have unintended consequences elsewhere as the body is an interconnected system (Freeman, 2015). However, if changes are deliberate and gradual, the body can be retrained to run in a more optimal position. Since running is such a natural activity, changing one's form can be difficult, especially in individuals that have been running for years. Retraining run cadence might require outside assistance such as a metronome or beat to follow as demonstrated in Allen's 2016 study of gait retraining. Being aware of one's fatigue and consciously trying to maintain good form will aid in injury prevention. Strengthening abdominal and back muscles will make maintaining proper form easier as well as aid in running efficiency (Vigil, 1995). Running form has wide-ranging implications regarding injury risk and performance and is an area that should be a focal point in training.

CHAPTER SIX

Footwear Risk Factors

Footwear is always a topic for discussion among runners as it is typically the only piece of equipment needed to run. While a shoe is unlikely to be the sole cause of injury, some types of footwear may be linked to several other risk factors that can contribute to ITBS. The type of footwear on a runner can be related to the type of foot strike that individual uses. The thick cushioning found in many modern shoes allows runners to land on the heel more comfortably. As previously mentioned, if the heel strikes the ground first, more shock is translated through the leg. The extra cushioning in some shoes, while allowing a more comfortable heel strike, does not reduce shock as much as an uncushioned midfoot or forefoot strike (Rothschild, 2012). The peak impact forces are reduced with lighter and lower profile shoes (minimalist shoes) due to the changes in running mechanics until the lowest forces are reached at full barefoot running (Rothschild, 2012). The reduction in shock stems from a combination of factors. The shifting away from heel striking comes from the natural tendency to utilize a midfoot or forefoot running style to maximize the effectiveness of the longitudinal arch for shock absorption (Rothschild, 2012). This shift coincides with a reduction in step length as well as an increase in cadence (Rothschild, 2012). As the study by Heiderscheidt et al found, both step length and cadence play a role in impact forces (2012). With the changes to the step length and cadence, the flight time and vertical oscillation are also reduced, lowering the braking force needed with each step (Rothschild, 2012). Due to the reduced cushioning in minimalist footwear and corresponding changes to step patterns, muscle preactivation in the gastrocnemius and soleus is higher, further reducing the shock upon landing, lowering the load on the muscles in the leg as well as on the stabilizers, including the ITB (Rothschild, 2012). Another advantage to minimalist or barefoot running is the improved proprioception of the foot during the stance phase. The direct contact of the foot to the ground leads to quicker reactions to changes in the surface, with the intrinsic muscles of the foot reducing the impact forces before the forces are transferred up the leg (Rothschild, 2012). The intrinsic muscles act as a shock absorber much like the cushioning in many modern shoes, but with the added benefits of reduced step length, increased step-rate and proprioception, and decreased vertical forces.

Changing from one type of shoe to another is a process that should be taken slowly in any circumstance, with time taken to break in the new shoes before the current shoes are completely worn out (Sallade & Koch, 1992). Making the switch to a minimalist shoe or a barefoot running style from a traditional running shoe should be taken even more gradually. Gradual progression over 4-8 weeks or more is necessary to allow the muscles, tendons, and ligaments to adapt to the new style and changed demands (Rothschild, 2012).

While there are several potential ITB injury reducing benefits to a more minimalist approach to footwear, there are some additional considerations needed. Not every runner will benefit from a change in footwear. Traditional shoes typically offer protection from potentially harmful terrain and objects that could cause injury to the feet, such as rocks or sticks. Orthotics are able to be fitted to traditional shoes that may be necessary to prevent or treat other types of injuries. Some people may not be able to switch to a midfoot or forefoot running style, in which case the heel cushioning in a traditional shoe would help reduce the force sent up through the heel (Rothschild, 2012).

Another risk factor for ITBS related to footwear is the condition of the shoes. Shoes typically offer a stable and cushioned platform for running. Over time and especially with many miles of running with the shoes, the cushioning in the shoes compresses and deforms from the original shape. Shoes should be replaced before the deformation reaches a level that puts the lower extremities at an increased risk of injury. Additionally, the midsole of a shoe will start to break down within two years regardless of distance run in the shoe (How Your Running Shoes Work, 2019). When the midsole starts to break down, particularly on the lateral edge, the likelihood of developing ITBS increases (Gose & Schweizer, 1989). The increased risk is due to the foot landing in a position that can cause the knee to go into varus, increasing contact between the ITB and lateral femoral epicondyle (Gose & Schweizer, 1989).

CHAPTER SEVEN

Physiological Risk Factors

Fatigue itself can play a role in the development of ITBS. Once fatigue begins to set in, a runner's biomechanics can be adversely affected, causing or increasing problems stemming from running form. Weakness in hip abductor muscles often leads to an increased shock being transferred to the ITB, which causes additional fatigue over the course of a run (MacMahon et al., 2000). The increased shock that fatigues the hip abductor muscles can also result from heel-striking, over-striding, or excessive amounts of running (MacMahon et al. 2000). Once the supporting muscles are fatigued, particularly the hip abductor muscles, their ability to diminish shock decreases, leading to further fatigue and damage to the tissues in a positive feedback loop, putting the ITB at a great risk of injury (MacMahon et al., 2000).

The fatigue from running may primarily come from the speed and distance of runs, but other environmental factors can add to fatigue as well. Outside of running, work demands, home needs, school requirements, and travel are all environmental conditions that affect fatigue (Vigil, 1995). While it may be difficult or even impossible to change some of these fatiguing factors, the effect of the factors can play a part in developing injuries from running. Sleep quality, sleep quantity, and nutrition are additional factors that play into total fatigue in an individual (Vigil, 1995). If the demands of training and these other common factors exceed the capability of the body to recover before more stimulus is added, overtraining and injury could result (Vigil, 1995).

Adjustments in training may be necessary to compensate for external stimuli that create excessive fatigue.

Integrating adequate recovery into training is essential. A recovery time of at least four to six hours between workouts is required for all runners, with the time period extended based on factors such as age, fitness, and diet (Vigil, 1995). In injured runners or in individuals at risk of developing ITBS, the amount of rest between workouts should be increased further to allow the body to build back up more completely (Hreljac, 2004). Allowing the muscles time to recover offers two benefits that counteract risk factors for ITBS: increased capacity and reduced fatigue. By allowing enough time between runs for the muscles to recover, the cumulative strain on the muscles will be lower so the muscles can more effectively be utilized to absorb the shock from each footstrike, sparing the ITB. With appropriate rest, the muscles will be able to adapt to the demands of runs and develop a greater capacity to more effectively control the motion of the leg.

Often a precautionary day off from running can benefit a runner in terms of both performance and injury risk more than pushing through another workout (Vigil, 1995). Rest days are especially important when considering an overuse injury such as ITBS because the stress on the ITB builds up cumulatively. Taking a rest day from training can also aid running economy, potentially leading to decreased fatigue when training is resumed (Vigil, 1995). While there are many benefits to getting appropriate time away from training, too much time can also have adverse effects as a result of detraining (Vigil, 1995). Finding a balance for training and rest can help a runner feel better before and after a workout (Vigil, 1995).

Cross training can be a way to maintain or improve fitness and manage fatigue in a way that does not put unnecessary strain on the ITB. Since ITBS primarily occurs in runners, engaging in other forms of aerobic activity and strength training can limit the load on a vulnerable ITB as well as build up the body in different ways than through running alone (Noble, 1979). The time away from running can also allow the body to recover from the repetitive stresses that come from running long distances (Hreljac, 2004). Except in severe cases of ITBS, pain is only prominent when the knee is flexed to 30°, so activities that spend minimal to no time in the impingement zone can be good ways to maintain fitness if the ITB is injured and to reduce injury risk in uninjured runners (Noble, 1979).

In addition to maintaining proper form, having the requisite musculature to handle the stress and strain of distance running is essential to countering or preventing ITBS. Deficiencies or imbalances in muscular strength can exacerbate other risk factors' potential to cause ITBS.

In runners, hip abduction is used to control frontal plane motion during the stance phase. According to a study by Fredericson et al., hip abductors in ITBS afflicted limbs are typically weaker than in uninjured limbs (2000). When the runners in the study were able to return to normal running, their hip abductor strength in the leg that had previously been injured was at least equal to that of their uninjured leg, showing a correlation of hip abductor strength and ITBS occurrence (Fredericson et al., 2000).

One of the major abductors affecting ITBS is the gluteus medius. If the gluteus medius is insufficiently strong to handle the demands placed on it during runs, control of hip abduction and external rotation suffers (Fredericson et al., 2000). As a result of the diminished control, the hip adducts and internally rotates, putting the ITB under tension and at risk of contacting the lateral femoral epicondyle (Fredericson et al., 2000).

Abdominal muscles are particularly important for runners and can help prevent twisting movements through the trunk, creating a more stable running platform (Vigil, 1995). The more stable the runner, the less chance of overworking stabilizers like the ITB. Proper motion throughout the trunk during running can reduce the risk of injury to the ITB (Foch, Reinbolt, Zhang, Fitzhugh, & Milner, 2015). When the hip abductors are unable to adequately control motion through the pelvis, there is a tendency for runners to develop a lean toward the side that the weak hip abductor is on (Foch et al., 2015). In order to maintain proper form so as to maximize performance and minimize injury risk, the muscles throughout the trunk should be strengthened so the trunk can be held upright throughout the phases of running (Foch et al., 2015). While the alteration in form does not address the underlying hip abductor weakness that caused the lean, the strain on the ITB is reduced when the trunk is held upright (Foch et al., 2015). Any hip abductor weakness should also be addressed to lessen the chance of developing an injury from a different variable related to abductor control.

CHAPTER EIGHT

Conclusion

With an activity as popular as running, injuries are a topic of great interest. With ITBS being one of the most common running injuries, understanding what ITBS is and what factors can contribute to the development of the syndrome is important for prevention. Knowing which risk factors may be relevant for an individual can aid in prevention of developing ITBS by allowing for potential interventions for the risk factors before the ITB becomes injured. Even if an individual already has ITBS, understanding the factors that may have contributed to the syndrome could aid in the treatment of ITBS by allowing the individual to work to reduce or eliminate the factors.

While impingement with the lateral femoral epicondyle is the primary cause of ITBS, there are a number of different factors that can lead to that impingement. Anatomical factors such as varus knee alignment, prominent lateral femoral epicondyles, tight ITB, leg length discrepancies, foot abnormalities that cause excessive pronation, internal femoral and tibial torsions, and previous injuries are all issues that can lead to ITBS. Training errors are often a primary risk for ITBS, including the lack of a properly designed training plan, sudden changes to running volume and intensity as well as the pace of runs. Frequent running downhill, running in the same direction on a track, running on one side of a cambered road, running in cold conditions, running without stable footing, and quick changes among different types of running surface are all environmental factors that can increase the risk of developing ITBS. Improper running technique in the form of heel striking, over-striding and low cadence is another area of risk for ITBS. The type and the condition of footwear can be additional factors that influence running mechanics, adding to the potential for ITB injury. Fatigue, inadequate musculature and recovery are three important factors that can influence the muscles of the lower extremities' abilities to prevent excessive shock going into the ITB. Any of these factors can increase the risk of developing ITBS. Combinations of any of these factors expose the ITB to even greater levels of risk.

ITBS is a painful and common running injury that has many potential areas of risk for developing the syndrome. Luckily, many of the risk factors for ITBS are problems that can be remedied with simple adjustments to certain areas of training. Some other risk factors may take more effort and time to counteract, but anatomical risk factors are probably the only factors that cannot be addressed to at least some degree. All runners can benefit from increased knowledge of injury risks and associated injury prevention strategies. When the chance of injury is lessened, more focus can be placed on the parts of running that bring people to the sport: Performance, fitness and a sense of accomplishment.

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