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Best Ways to Treat Shin Splints: A Review of Literature

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Abstract: ***Shin splints, a common lower leg injury, can be debilitating not only for athletes, but anyone who engages in excessive strain during exercise. This literature review explores various approaches to treating shin splints and provides insights into the underlying causes of the condition. The review begins by discussing the importance of understanding lower extremity injuries and their impact on performance. It then delves into studies that examine the effects of shoe therapy on lower extremity injuries, highlighting different types of shoes and modifications used to reduce impact forces during running. The review further focuses on shin splint-specific research, which includes defining the condition, measuring forces exerted on the shin during running, and exploring treatment effectiveness through surveys and professional opinions.***

Keywords: shin splints, shoe therapy, stress fracture, shin

1. Introduction

The ability to move and be active are some of the most fundamental parts of human existence. Even before the development of fire, humans were on their feet running from predators, hunting prey, and moving through life. One major hindrance to this movement is leg injuries. Specifically lower leg injuries such as shin splints, which are most common among endurance athletes.

Ever since the fitness boom in the early 1960s - a time when fitness became a driving factor in people's lives - this fact has become common knowledge among the medical community (Bates, 1985). This has prompted organizations like the American Medical Association (AMA) to try and produce universal definitions of these injuries, to settle the debate. A passage from a sports medicine journal highlights this: "In 1968 the American Medical Association (AMA) published the "Standard Definition of Athletic Injuries" after canvassing the opinion of hundreds of physicians, trainers, and physical educators. They defined shin splints as "pain and discomfort in the leg from repetitive running on hard surfaces or forcible extensive use of flexors" (Bates, 1985). This presents a strong foundation, and was widely accepted at the time, but is disputed by current research.

There are three major limb structures that play a key role in the occurrence of shin splints and their many forms. The first is the Achilles Tendon (AT) which is in the back of the heel. It connects the calf and soleus muscles to the calcaneus bone located on the bottom of the heel. It facilitates movement of the foot in a downward motion, away from the leg (Piedade et al, 2019). As it connects the calcaneus bone it is the cause for many injuries to the back of the shin because of overuse. When athletes complain about pain relating to the AT it manifests as discomfort and tenderness on the back and middle in the lower part of the leg. The main causes of this type of injury occur because of overuse, misalignment in the lower extremities, history of injury, and training on poorly made work surfaces (Piedade et al, 2019). As is characteristic with shin splint injuries, overuse of the Achilles tendon can cause inflammation in the posterior of the leg that can only be fixed with rest, ice, and proper training shoes.

The next area of interest is the Posterior Tibial tendon located on the inner side of the foot. It takes a similar route to the Achilles tendon but starts in front of it. This tendon is responsible for facilitating the inversion of the foot and plays a role in maintaining the arch of the foot. This is put under strain when the duration, intensity, and volume of activity remains for long periods of time or increases to levels it cannot support. When this happens, athletes complain about pain along the tendon and surrounding areas. At more advanced stages in this injury, acquired adult flatfoot can develop leading to more complicated issues including higher risk of developing chronic shin splints (Piedade et al, 2019).

The third and final leg structure that plays a role in the formation of shin splints is the Anterior Tibial Tendon (ATT). This tendon reaches from the inside of the foot and crosses the shin beginning to approach the outside of the knee. This is one of the most prominent areas that shin splints occur in, as it plays the role of tilting the foot upward. Piedade states that the ATT's role in leg mechanisms is the dorsiflexion or tilting upward of the foot and inversion or rotating inward of the foot. When athletes report pain relating to the ATT discomfort and swelling are present on the inner side of the leg. When resistance is applied to the inversion and dorsiflexion of the foot this effect is amplified, causing more pain and injury. (Piedade et al, 2019). Again, it is demonstrated that overuse issues are at the core of shin splint injuries and are exacerbated by poor equipment. Research is still being done on the types of shin splints, and their causes. Information such as this is constantly being challenged and disputed, which can make the field seem volatile at times. This just shows the energetic nature of shin splint research which branches off from lower extremity injuries.

1.2 Lower Extremity Research

To understand shin splints, it is essential to first look at the literature present pertaining to lower extremity research. The techniques and ideas are similar in many ways, and build off each other. The first type of study relating to this topic is the study concerning the effect of shoe therapy on lower extremity injuries. The major cause of injury that these studies focus on is running, and its dynamics, as about 19.4% to 79% of runners sustain an injury. Of these injuries, 97% are of the lower limbs, which presents a valid reason to study them (Relph et al, 2019). As a solution, running shoes with various modifications are used to evaluate the impact on lower extremity injuries. A review from 2019 analyzed the different types of shoes and their modifications in relation to lower extremity issues. They found that studies contained: cushioned and neutral shoes, used to reduce impact force when striking the ground; motion reducing shoes, made to reduce motion around the foot when making contact with the ground; stability shoes, made to offer both reduction and cushioning; and minimalist running shoes, made to mimic the act of being barefoot with high levels of flexibility and not much else(Relph et al, 2019). Some studies of this nature also employ the use of similar shoes that have a combination of added features. This allows for more possibilities of therapy andevaluates many designs. These studies typically use a variety of shoes, as this will help decide which shoes will help reduce impact while running (Relph et al, 2019).

The features on the types of shoes used aim to zero in on specific parts of the lower extremities, and achieve this by: incorporating motion control features, features that change foot striking patterns, and modification of impact forces to areas of the lower extremities (Relph et al, 2019). Relph examined some studies treating specific leg injuries. They discussed that since different running shoe models may augment different lower extremity issues it is possible to reduce specific injuries tied to those areas. They continued saying that in studies where an elevated heel is used it may decrease the strain placed on the Achilles tendon, preventing Achilles tendon injury. This is the same with Subtalar motion control inhibitors that may treat the areas of the leg associated with the joint (Relph et al, 2019). Many other studies have these findings, which is to say that certain areas can be specifically targeted when it comes to mitigation.

When it comes to these studies on the lower extremities, outcomes tend to differ, especially given such a broad range of applications. Although some studies concluded that shoe therapy could be useful in treating lower extremity injuries, they may have data that leads them to cast doubts on the efficacy. One such study conducted a trial on 20 participants discussing its results with uncertainty. They found that even though there was a decrease in vibrational force on the runners, this only represents a small percentage of the actual vibrations. Given this they concluded that the use of cushioned shoes may not fully compensate for all the vibrational forces that runners experience. They then proceeded to ask new questions about whether low impact forces really account for many leg injuries (Carlos et al, 2018). This study casts doubt on the efficacy of shoe therapies, when it comes to decreasing impact vibrations, and suggests an alternative way of moving forward. It does recognize that it has a small sample size and takes this into account.

1.3 Shin Splint Research

The next level down from lower extremities is shin splint specific research. This research is similar in many ways to the broader topic of lower extremity injuries, but with a more specialized view of the subject. The first major branching point is the definition of shin splints. A very general definition that encompasses the entire diagnosis is “pain and discomfort localized on the front outside or medial side of the lower leg” (Piedade et al, 2019). The way studies choose to define shin splints is an integral part of the research and will be discussed later. The second branching point for shin splint specific research is the means of treatment. While lower extremity research encompasses a wide range of variations for treatment, most shin splint papers focus on stabilization, cushioning, and correction. The literature indicates that there are three main causes of shin splints: bone stress, inflammation of tissue, and pressure increases inside the structure of the leg. This is supported by anatomical studies, observations during surgery; raw data, such as imaging of the anatomy in motion (Kamath et al, 2019). These shin splint causes line up one to one with these methods of treatment and present some grounds for the adaptation of these ideas into treatment (Relph et al 2019, Kamath et al 2019).

The methods used to construct and conduct the literature associated with shin splints are mostly unique but can be placed under 3 main categories. The first type of research that is displayed in the field are medical journals that simply define shin splints, and how it is diagnosed and treated. Like others this journal from 2019 contains a definition for shin splints that it can base its work off. It states that shin pain, shin splints, and MTSS are different ways of expressing the condition of pain in and around the lower leg (Piedade et al, 2019). There are other journals like this, that provide definitions of shin splints, and constantly keep the definition debate going (Relph et al 2019, Piedade et al 2019).

Next, the second type of papers that are published are papers that measure the forces imparted on the shin while running. These studies use pressure and movement sensors to obtain information about the pressure exerted on the foot using insoles, compared to a control like running barefoot. A cross-sectional study from 2018 used this method to assess the impact forces on the leg using insoles. This study consisted of 10 km runners who had accelerometer devices on their persons. They used the time and frequency data that they received from the accelerometer to calculate the impact forces during running. They then compared the forces with the insoles against the forces barefoot and found that there was a decrease of impact forces (Carlos et al, 2018). The technology used to gather data in this study, accelerometry, allows the researchers to receive vibrational readings from the lower extremities. The use of such technology allows for a smaller number of participants, as the technology used is quite accurate (Karas et al, 2019).

Research on shin splints can also be conducted on a larger scale with studies that include surveys from participants on treatment effectiveness that are also backed up by professional opinions. One such study used a military population using the same method to obtain data: "This contrasted with the report of Swenson who reported a substantial positive effect using the Aircast leg brace in the treatment of tibial stress fractures in a collegiate athlete population." (Johnston et al, 2006). While these are the main types of ways researchers analyze shin splints and their treatment, there are many other studies that branch off a bit from this approach. One study done in 2006 analyzes the effects of cryotherapy on shin splints, to contrast with the different ways of treating shin splints. This study included a naval military population of 2700, in which they evaluated the effects of ice and rest. It found that this combination alone produced a more favorable course of therapy than any other treatment (Johnston et al, 2006). This highlights the variety that is present among shin splint research, even with such specialization.

Given the variety of similar outcomes amid the research on shin splints and its treatment, there are still aspects of the ailment that researchers often disagree about. A review on this issue states that this confusion and argument among the medical community on what causes shin splints makes it more difficult to prevent and treat symptoms. It also states that the multitude of theories, studies, and plans of action associated with shin splints makes it hard for the research community to come together on one true definition or treatment for the injury (Yamasaki, 2019). This lack of a concrete definition has led to many branching definitions of shin splints, which makes it hard to diagnose, and can lead to certain variations of shin splints being left out of studies for ease of identification (Yamasaki, 2019).

One of the earliest definitions of shin splints that the scientific community went with was "pain and discomfort in the leg from repetitive running on hard surfaces or forcible extensive use of flexors ... The diagnosis should be limited to musculotendinous inflammation, excluding a stress fracture or ischemicdisorder" (Bates, 1985). This was widely criticized as it confined shin splints to musculotendinous and left out the bone which is a major part of the aliment. As well as this, the definition did not stress the shin aspect of the injury (Bates, 1985). This has led the term shin splint to become up to interpretation. In the recent decade there has also been a movement toward the replacing of the term shin splint with MTSS (Couture and Karlson, 2015). While this solves the issue of including the bone aspect of the injury, it fails to include any other aspect. This definition really focuses on a specific condition that has its roots in the results from a bone scan after clinical analysis. MTSS demonstrates a reaction to stress within the bone, where the healing of the structures becomes warped (Couture and Karlson, 2015). Given the criticism also associated with this approach, a more agreed-upon alternate term for shin splints is "tibial stress injuries" (Couture and Karlson, 2015). This term aligns more closely with the different injuries that can be placed under the term shin splints. It does not, however, include other differential diagnoses that occur in that region of the leg.

The cause of shin splints has also been long debated and can depend on the type of shin splints that are being treated. This however does not mean that differing situations cannot be compared to come to a more accurate conclusion (Relph et al, 2019). One example of this situation is one study from the American Journal of Sports Medicine that suggested a different cause of the injury. They state that for a long time the understanding in the scientific community was that the Tibialis Posterior muscle, located directly behind the shin bone, was responsible for shin splints. They challenged this with their own study and found that the TP muscle has less of an effect than has been proposed (Michael and Holder 1985).

This study conducted several trials in which it concluded that the soleus muscle is responsible for most shin splint injuries. It is located on the back side of the shin and works in tandem with the calf. Their reasoning behind this was that it was responsible for the pronation of the heel which contributes to extra force placed on the shin and surrounding muscle as a result (Michael and Holder, 2015). This provides an example of the comparison process in action, as two different muscles with different jobs were compared to come to a more accurate conclusion (Michael and Holder, 2015). While this is builtfromexisting knowledge of heel pronation its source is disputed by many other studies and reviews concerning the injury. One of these studies involves a comprehensive overview of shin pain in which it states a different cause for shin splints. This study states that the root of the problem is the Anterior Tibial Tendon, which runs across the front side of the shin (Piedade et al, 2019). Although this debate has been occurring within this branch of research for many years, it is an integral part of the constant development of thinking and treating shin splints.

1.4 Shoes and Shin Splints

The most important process that needs to take place when dealing with an injury is prevention. While there are many ways to prevent lower extremity issues, some of them are not options for some people, particularly athletes. When athletes participate in sports that focus on the leg, injuries often get played through when told to pursue more proven methods like resting. Improving the equipment is the next best option for athletes, and in this case, it is the shoe. Some main parts of the shoe that help prevent injury in athletes are stabilization, dissipation, and correction (Carlos et al 2018, Piedade et al 2019, Relph et al 2019). A study conducted on military trainees in 2019 highlights the effects of stabilization of the foot. This study followed two groups of military cadets. One group had shoes that were stabilized, and the other group had regular issue training boots. Throughout the course of training the modified booted soldiers experienced a 33% shin splint reduction rate compared with the cadets without the modifications (Helton et al, 2019). Stabilization helps prevent unwanted vibration of the foot that increases the chance of developing shin splints (Carlos et al, 2015). The next aspect that is thought to help with shin splints mitigation is dissipation. The addition of cushioning in shoes has been shown to decrease the force placed on the shin and surrounding structures. This is already present in many shoes, but these studies incorporate a type of cushioning that is specialized for shin splints

(Carlos et al 2015). The last major aspect that studies focus on when it comes to providing shoes to mitigate shin splints is correction. A major part of moving is foot landing, which can exacerbate the injury that occurs while running if done improperly (Couture and Karlson, 2002). Some have a condition in which this improper stepping is abnormally large because of over and super pronation. This can cause irregular distribution of force throughout the leg increasing the risk of shin splints. With the use of specialized shoes, force can be evenly distributed reducing the presented risk in these people (Piedade et al 2019, Couture and Karlson 2002, Carlos et al 2015). Research on this topic is not as abundant as others, given its extreme specialization. The research, however, does not contain too many variations in the results that are concluded.

2. Conclusion

Building from the world of lower extremity injuries, shin splint research has a long way to go before it can be fully implemented in future shoe design. Currently there is not much material in which they are evaluating the use of shoes in shin splint therapy, but as time goes on there is potential for it to gain more evidence behind it. Should this happen, it would provide an opportunity for people, especially athletes, to continue to train in a safe manner, while not taking weeks off from their profession for this injury (Mechelen, 1997). Overall, this research can really maximize the amount of work people can put into their work or hobbies, applying design techniques for other injuries, which creates a healthier fitness community overtime.

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