International Journal of Physical Education & Sports Sciences
Vol. 18, Issue No. 1, January-2023, ISSN 2231-3745

DOI: https://doi.org/10.29070/rvvd3b48

Check for updates

Effect on Sports Performance and Biomechanics on Calcaneal Spur of Athletes

Neethi M. [1] * , **Dr. Ravi Shankar Ravi** [2]

1. PhD Scholar, CMJ University, Jorabat, Ri-Bhoi, Meghalaya , India
drmneethi@gmail.com ,
2. Dean of Allied Health Science, Capital University, Koderma, Jhumri Telaiya, Jharkhand, India

Abstract: Players are able to master the technical motions with the assistance of sports biomechanics, and coaches are able to recognise and correct any executive flaws that may already be present in their athletes. In order to achieve these goals, scientists and professionals are increasingly looking to technology for aid. This is not just to improve performance, but also to lessen the likelihood of accidents occurring among themselves and other people. In particular, non-invasive methods, such as the LiDAR technology, which is able to analyse the morphology of the spine via the use of a 3D scanning approach, have shown their validity in the monitoring of the athletes' physical condition in order to treat low back pain in sports. A calcaneal spur may be found either at the back of the heel (also known as a dorsal heel spur) or under the sole of the foot (also known as a plantar heel spur). Both of these locations are different from one another. Spurs that are located on the dorsal side of the foot are commonly associated with achilles tendinopathy, while spurs that are located under the sole of the foot are frequently identified as being associated with plantar fasciitis.

Keywords: Sports , Performance , Biomechanics , Calcaneal Spur , Athletes'

X

INTRODUCTION

When a bony protrusion develops on the heel bone, this condition is known as a calcaneal spur, which is also often referred to as a heel spur. Both of these terms are associated with the same ailment. A calcaneal spur may be found either at the back of the heel (also known as a dorsal heel spur) or under the sole of the foot (also known as a plantar heel spur). Both of these locations are different from one another. Spurs that are located on the dorsal side of the foot are commonly associated with achilles tendinopathy, while spurs that are located under the sole of the foot are frequently identified as being associated with plantar fasciitis.

It is conceivable that the apex of the spur is situated either inside the origin of the planter fascia (on the medial tubercle of the calcaneus) or above it (in the origin of the flexor digitorum brevis muscle).

Both of these locations are feasible. Because of the relationship between spur growth, the medial tubercle of the calcaneus, and the intrinsic heel muscle, the plantar fascia is subjected to a continuous pulling action, which finally results in an inflammatory reaction. This is the case because of the connection between these three structures.

Chronic Mechanical Stress and Overuse

One of the most important elements that contributes to the development of calcaneal spurs is the presence of chronic mechanical stress as well as overuse. As a consequence of the continual stresses that they experience when jumping, running, and landing, athletes, particularly runners, dancers, and those who

engage in high-impact sports, often incur recurring stress to the heel bone. This is especially true for athletes who are involved in high-impact sports. Microtears are formed in the plantar fascia and other soft tissues as a result of this recurring stress, which in turn encourages the body to deposit calcium at the location in attempt to maintain the structure's integrity. Calcium builds up over time, which eventually results in the formation of a bony protrusion that is known as a heel spur. This protrusion is caused by the buildup of calcium.

Plantar Fasciitis and Chronic Inflammation

The inflammation of the plantar fascia, which is a thick band of connective tissue that runs along the bottom of the foot, is one of the most common conditions that are associated with calcaneal spurs. Plantar fasciitis is one of the most common illnesses that are associated with calcaneal spurs.

The accumulation of calcium is caused by prolonged irritation and inflammation at the attachment point of the plantar fascia on the calcaneus, which finally leads to the formation of a bony spur. This is the cause of the accumulation of calcium. Plantar fasciitis patients who have been experiencing symptoms for a considerable amount of time are at a significantly elevated risk of developing heel spurs. Specifically, this is due to the fact that inflammation creates an environment that is conducive to the creation of bone.

Improper Foot Biomechanics and Poor Footwear

Foot mechanics that are abnormal, such as having flat feet (also known as overpronation) or having high arches (also known as supination), may contribute to an unequal distribution of weight over the foot, which can result in excessive pressure being placed on the heel.

It is possible that this extreme stress may, over time, encourage aberrant bone formation. It is also possible for unsuitable footwear, such as shoes that do not provide enough arch support, shoes with high heels, or soles that are worn out, to worsen the strain that is placed on the heel, which in turn speeds up the development of calcaneal spurs. Walking barefoot on hard surfaces for extended periods of time might also potentially lead to the development of heel spurs and stress on the heel.

Aging and Degenerative Changes

In addition to being a significant risk factor for the development of calcaneal spurs, being older is a significant risk factor. The suppleness of the plantar fascia and other connective tissues declines with growing age, which makes them more prone to microtears and inflammation.

This is because of the fact that they are more sensitive to damage. Specifically, this is the case with regard to the plantar fascia. Additionally, the natural wear and tear that comes with becoming older is a factor that adds to the gradual degeneration of foot tissues, which in turn raises the chance of heel spur formation. This is a component that contributes to the progression of the condition. In addition, as individuals become older, the fat pad that is located behind the heel and acts as a cushion has a tendency to get thinner. As a consequence, the heel bone is subjected to a greater amount of pressure, which in turn raises the probability that spurs may form.

Medical Conditions and Lifestyle Factors

There are a number of factors that may contribute to the formation of calcaneal spurs, including individual lifestyle decisions and certain systemic disorders. Because extra body weight exerts additional tension on the arch and heel of the foot, obesity is a key contributing factor. This stress increases the risk of soft tissue inflammation and spur development, which may lead to problems with the foot.

In addition, diabetes and metabolic diseases may play a role by influencing circulation and tissue repair, which in turn makes patients more prone to chronic inflammation and calcium deposition. In addition, those who suffer from arthritis, including osteoarthritis and rheumatoid arthritis, have a higher risk of developing calcaneal spurs. This is because persistent joint inflammation and bone remodelling processes are the causes of these spurs from developing.

Additional lifestyle variables, such as standing for extended periods of time, walking on hard surfaces for an extended period of time, and leading a sedentary lifestyle, may also contribute to heel stress.

It is possible that individuals who abruptly increase their physical activity without having properly prepared themselves may also face an increased risk. This is because their muscles and tendons may not be fully prepared for the extra strain that is placed on the heel.

Calcaneal spurs are caused by a number of different variables that are interconnected with one another. These factors include biomechanical malfunctions, persistent inflammation, inappropriate footwear, ageing, systemic disorders, and lifestyle choices. Although it is possible that these spurs may not always produce pain, they are often linked to plantar fasciitis and heel discomfort. This is especially true in athletes and other persons who participate in sports that involve high-impact movements. In order to avoid and effectively treat calcaneal spurs, it is helpful to have an understanding of the reasons and risk factors that contribute to their development. This will result in improved foot health and mobility.

OBJECTIVES OF THE STUDY

1. To study on Plantar Fasciitis and Chronic Inflammation

2. To study on Pathophysiology of Calcaneal Spur-Associated Pain

DIFFERENCES BETWEEN DORSAL AND PLANTAR CALCANEAL SPURS

Calcaneal spurs are often the result of chronic stress, inflammation, or biomechanical issues. In other situations, they may also be the result of pain. The presence of these abnormal bony outgrowths, which are formed on the heel bone (calcaneus), is what distinguishes them from other anatomical features. Calcaneal spurs may be broken down into two basic categories: dorsal (posterior) calcaneal spurs and plantar calcaneal spurs. Both of these types of spurs are known as calcaneal spurs. There are a number of factors that differentiate these spurs from one another, including their placements, aetiology, symptoms, and treatment approaches.

The dorsal calcaneal spur, which is also known as the posterior heel spur, is a kind of spur that forms near the back of the heel, close to the point where the Achilles tendon and the calcaneus connect. It is also known as the posterior heel spur. These spurs are often the result of chronic

Achilles tendinitis or excessive strain on the tendon, which may be caused by repeated activities such as running, jumping, or wearing shoes that do not fit well and have rigid backs. In addition, the development of these spurs might be a consequence of the repetitive nature of these activities. These disorders often manifest themselves with symptoms such as pain, swelling, and discomfort in the back of the heel. These symptoms are particularly obvious when the individual is wearing footwear that is excessively tight. It is possible for them to produce Haglund's deformity, which is a bony overgrowth that further irritates the soft tissues that are around the afflicted location. This may happen in severe circumstances.

On the other hand, plantar calcaneal spurs are distinguished by the fact that they develop on the bottom of the heel, in close proximity to the site where the plantar fascia inserts. People who have these issues are often associated with the condition known as plantar fasciitis, which is marked by inflammation of the plantar fascia as a consequence of excessive stress or biomechanical irregularities associated with the plantar fascia. These spurs are more prone to develop in people who have flat feet, high arches, obesity, or who engage in activities that require them to stand for lengthy periods of time. It is possible for plantar spurs to produce a sharp, stabbing pain in the heel, particularly in the morning or after extended periods of rest. This is because the irritated plantar fascia pushes on the calcaneus. The morning is the most usual time for experiencing this sort of pain.

Pathophysiology of Calcaneal Spur-Associated Pain

The continuous mechanical stress, inflammation, and soft tissue degeneration that are the key contributions to the pathophysiology of calcaneal spur-associated pain are the primary factors since they are the primary contributors to the syndrome. The Achilles tendon (in the case of dorsal spurs) and the plantar fascia (in the case of plantar spurs) are the attachment sites of tendons and ligaments that are responsible for the development of calcaneal spurs. These spurs are formed by repeated microtrauma at these attachment points. The natural healing response of the body, which is prompted by the constant stress that people encounter, brings about calcium deposits and the gradual formation of a bony protrusion. These are the outcomes of the body's natural healing reaction.

It is possible that microtears and inflammation at the heel bone might be caused by an excessive amount of pressure placed on the plantar fascia, which would eventually lead to the development of plantar fasciitis. Plantar calcaneal spurs are a condition that is related with this ailment. Over the course of time, prolonged exposure to stress may lead to the development of fibrosis, the breakdown of collagen, and an abnormal ossification process, all of which finally culminate in the construction of a bony protrusion. There are instances in which the spur itself does not experience any pain; rather, the inflammation, nerve irritation, and thickening of the plantar fascia that are associated with it are elements that contribute to chronic discomfort and stiffness in the heel.

Frequent strain on the Achilles tendon, which is the origin of dorsal calcaneal spurs, may lead to chronic inflammation, degenerative changes, and enthesopathy around the insertion site of the Achilles tendon. These symptoms are the consequence of the Achilles tendon being subjected to repeated strain. The stimulation of osteoblastic activity that is brought about by mechanical stress is what leads to the development of bone overgrowth. As the spur becomes bigger, it is possible for it to press on the soft tissues that are next to it. This may cause pain, swelling, and a restriction of movement, particularly when

the spur is being used in conjunction with physical activity.

Rather than being caused by the bony spur itself, the pain that is associated with calcaneal spurs is often produced by chronic inflammatory responses, nerve irritation, and pressure on the soft tissues that are near to the spur. This is because prolonged inflammation may create nerve irritation. A number of factors, including being overweight, having poor biomechanics, participating in activities that have a high impact, and standing for lengthy periods of time, are contributing factors that make the condition worse. When it comes to developing effective treatment choices, it is beneficial to have a solid grasp of the pathophysiology that lies behind the disorder. Shockwave treatment, orthotic support, physical therapy, and anti-inflammatory medicines are some of the procedures that fall under this category. The purpose of these techniques is to alleviate symptoms and to avoid further advancement in the future.

Impact on Athletes and Daily Activities

A. Effect on sports performance and biomechanics

It is the study of the motion of bodies and the things that impact it that is referred to as biomechanics, and it is applied to humans. To put it another way, it is the process of applying the fundamentals of mechanics to the investigation of human movement. The study of the mechanics of movement in sports was established in order to allow the quantitative assessment of athletic gestures. This was the primary motivation for the development of this field of research. This indicates that the movement may be measured without taking into consideration the forces that made the movement possible (this is referred to as kinematics), or the movement can be quantified by identifying the internal and/or external forces that caused the movement (this is referred to as kinetics).

Players are able to master the technical motions with the assistance of sports biomechanics, and coaches are able to recognise and correct any executive flaws that may already be present in their athletes. In order to achieve these goals, scientists and professionals are increasingly looking to technology for aid. This is not just to improve performance, but also to lessen the likelihood of accidents occurring among themselves and other people. In particular, non-invasive methods, such as the LiDAR technology, which is able to analyse the morphology of the spine via the use of a 3D scanning approach, have shown their validity in the monitoring of the athletes' physical condition in order to treat low back pain in sports. The infrared method of thermography has the potential to be a good way for examining the thermal muscle response to spinal alterations. This is similar to the example that was shown before. The recent advancements in technology have made it feasible to construct portable and wearable devices that allow the evaluation of technological gestures away from laboratories, namely in the field. These technologies have made it possible to develop these technologies. When it comes to running, for example, the use of pressure insoles has the advantage of permitting the gathering of data on the vertical ground response forces in a physical situation that is realistic of the game. This is a significant advantage. In a similar vein, the use of inertial sensor technology for the purpose of real-time performance assessment in combat sports is becoming more widespread.

B. Functional limitations and gait abnormalities

The difficulty in identifying a functional gait disorder is due to the fact that there are a variety of elements that contribute to the difficulty. When it comes to gait patterns, there is not a single pattern that can be used

to diagnose a disease. In the medical community, there is a widespread misunderstanding that functional gait abnormalities are identical with peculiar clinical symptoms.

On the other hand, this is a diagnostic error since biological gait abnormalities may also result in peculiar gait patterns. People who have choreatic or dystonic gait features are more likely to have this kind of occurrence. In addition, it is important to take into consideration the possibility that functional gait disorders may have clinical features that are comparable to those of organic gait disorders. A buckling gait, for instance, is an example of a typical phenotype of a functional gait. This kind of gait is distinguished by the knees having a tendency to give way. Nevertheless, it is also feasible for people who have negative myoclonus of the lower limbs to have this gait. This is something that may happen.

Additionally, the existence of an organic gait issue does not exclude the potential of a superimposed functional component also occurring, and vice versa. This is because the two elements are not mutually exclusive. In circumstances in which there is a clear functional gait impairment, it is probable that there is also an underlying organic sickness. this is something that should be considered. As a consequence of this, it could be advantageous to conduct out supplementary testing in order to rule out the potential of concurrent organic neurologic issues that are operating under the surface. When it comes to the diagnosis of a functional movement disorder that has been clinically proven, on the other hand, the detection of typical supporting aspects is the primary factor that is required. These characteristics include a lack of consistency and a lack of congruence with organic gait abnormalities. It is not enough to just eliminate biological gait problems to the maximum degree feasible. Such an approach is insufficient.

One example of inconsistency is the existence of fluctuations in the severity of gait abnormalities over the course of time that cannot be explained by any specific explanation. In spite of the fact that there are certain individuals who are able to walk in normal circumstances, it is not feasible for them to walk when they are being evaluated physically. It is likely that members of the family may sometimes comment on a distinct walking pattern that they are observing during the test in contrast to the gait pattern that is present at home. This is something that is feasible during evaluations. In addition, there are certain patients who have a substantial amount of trouble walking while being observed, but they move very well when they are moving of their own will, such as when they are in the examination room or when they are getting dressed or undressed while they are being observed. Another example of unexplained variability is the absence of falls in spite of significant gait impairments. Furthermore, this group include both spontaneous remissions and exacerbations that occur during the course of your lifetime. Inconsistency may also occur when there is a disparity between the objectively visible severity of the gait impairments and any limitations that the person has self-reported feeling while engaging in activities of daily living. This is an example of inconsistency. The difference might go either way, which means that a considerable gait impairment could be seen during the evaluation, but there might not be any limitations when it comes to activities of daily life. However, even in the presence of relatively minor gait problems, it is possible to have significant limitations in the tasks that are part of everyday living.

Incongruency is connected with a variety of symptoms and indications that are not seen in organic gait disorders. These symptoms and indicators don't appear in organic gait disorders. In the absence of a structural lesion or a traumatic incident, for example, a quick onset or rapid development of gait

abnormalities is very uncommon. quick development of gait abnormalities is uncommon. The delayed development of gait impairment after a (minor) trauma is another example of incongruency that might occur. Bringing about the incongruency may also be accomplished by the use of the neurologic examination, which is another way. The antalgic gait, in which there is no pain, and the buckling gait, in which the knees give way, in the presence of sufficient quadriceps strength, are two instances of gaits that might be regarded abnormal. Both of these gaits are examples of gaits that are thought to be abnormal. One other evidence of this is a scissoring gait, which is a gait that happens when there are no signs linked with the corticospinal tract, such as quick reflexes or stiffness in the hip adductors. There are instances in which the pattern itself is just not coherent with the way the neurological system is working. As an illustration of this, consider the case of a patient who was said to walk in a recumbent position and who continued to make walking motions with her legs even when laying down on her back with her eyes closed. An improvement in the gait pattern when the patient is deliberately completing a dual task, which might be of a cognitive or motor nature, is another evidence of both inconsistency and incongruency. This improvement can be seen when the patient is walking normally.

CONCLUSION

The stimulation of osteoblastic activity that is brought about by mechanical stress is what leads to the development of bone overgrowth. As the spur becomes bigger, it is possible for it to press on the soft tissues that are next to it. This may cause pain, swelling, and a restriction of movement, particularly when the spur is being used in conjunction with physical activity. Rather than being caused by the bony spur itself, the pain that is associated with calcaneal spurs is often produced by chronic inflammatory responses, nerve irritation, and pressure on the soft tissues that are near to the spur. This is because prolonged inflammation may create nerve irritation. A number of factors, including being overweight, having poor biomechanics, participating in activities that have a high impact, and standing for lengthy periods of time, are contributing factors that make the condition worse. The infrared method of thermography has the potential to be a good way for examining the thermal muscle response to spinal alterations. This is similar to the example that was shown before. The recent advancements in technology have made it feasible to construct portable and wearable devices that allow the evaluation of technological gestures away from laboratories, namely in the field. These technologies have made it possible to develop these technologies.

References

1. ML, Shepstone L, Donell ST, Thomas TL. Shock wave therapy for chronic Achilles tendon pain: a randomized placebo-controlled trial. Clinical orthopaedics and related research 2005;440:199- 204.
2. Cote P, van der Velde G, Cassidy JD, et al. The burden and determinants of neck pain in workers: results of the Bone and Joint Decade 2000-2010 Task Force on Neck Pain and Its Associated Disorders. Spine 2008;33:S60-74.
3. Crossley KM, Bennell KL, Cowan SM, Green S. Analysis of outcome measures for persons with patellofemoral pain: which are reliable and valid? Archives of physical medicine and rehabilitation 2004;85:815-22.

4. Crowther MA, Bannister GC, Huma H, Rooker GD. A prospective, randomised study to compare extracorporeal shock-wave therapy and injection of steroid for the treatment of tennis elbow. The Journal of bone and joint surgery British volume 2002;84:678-9.

5. D'Ambrogi E, Giurato L, D'Agostino MA, et al. Contribution of plantar fascia to the increased forefoot pressures in diabetic patients. Diabetes care 2003;26:1525-9.

6. Daecke W, Kusnierczak D, Loew M. Long-term effects of extracorporeal shockwave therapy in chronic calcific tendinitis of the shoulder. Journal of shoulder and elbow surgery / American Shoulder and Elbow Surgeons [et al] 2002;11:476-80.

7. Davis PF, Severud E, Baxter DE. Painful heel syndrome: results of nonoperative treatment. Foot & ankle international 1994;15:531-5.

8. Rompe JD, Nafe B, Furia JP, Maffulli N. Eccentric loading, shock-wave treatment, or a wait-and-see policy for tendinopathy of the main body of tendo Achillis: a randomized controlled trial. The American journal of sports medicine 2007;35:374-83.

9. Rompe JD, Overend TJ, MacDermid JC. Validation of the Patient-rated Tennis Elbow Evaluation Questionnaire. Journal of hand therapy : official journal of the American Society of Hand Therapists 2007;20:3-10; quiz 1.

10. Rompe JD, Riedel C, Betz U, Fink C. Chronic lateral epicondylitis of the elbow: A prospective study of low-energy shockwave therapy and low-energy shockwave therapy plus manual therapy of the cervical spine. Archives of physical medicine and rehabilitation 2001;82:578-82.

11. Sabeti M, Dorotka R, Goll A, Gruber M, Schatz KD. A comparison of two different treatments with navigated extracorporeal shock-wave therapy for calcifying tendinitis - a randomized controlled trial. Wiener klinische Wochenschrift 2007;119:124-8.

12. Salaffi F, Stancati A, Silvestri CA, Ciapetti A, Grassi W. Minimal clinically important changes in chronic musculoskeletal pain intensity measured on a numerical rating scale. Eur J Pain 2004;8:283- 91.

13. Salen BA, Spangfort EV, Nygren AL, Nordemar R. The Disability Rating Index: an instrument for the assessment of disability in clinical settings. J Clin Epidemiol 1994;47:1423-35.