continuing ED

Volume 2, Issue 5
September 2007

clinical conduit

Plantar Fasciitis

The Evidence for Evaluation and Conservative Management: **Part 1**

Inside this issue

Plantar fasciitis is the most common foot condition treated by healthcare providers according to a survey conducted by the Foot and Ankle Special Interest Group from the Orthopedic Section of the American Physical Therapy Association. It has been estimated that the incidence of the condition is about 10% over the course of a life time with approximately two million Americans currently affected resulting in a prevalence of around 1%. The pathology is typically caused by repetitive microtrauma resulting in collagen degeneration at the origin of the plantar fascia on the medial calcaneal tubercle. The histological evaluation of 50 surgical cases supports the contention that this condition is a degenerative and not an inflammatory condition.[28]

ANATOMY

The plantar fascia is a dense, multi-layered fibrous connective tissue on the sole of the foot. It is made up of three bands (medial, central, and lateral) that are approximately 2-4 mm thick. The medial band is the thickest of the three and the one most commonly involved in the pathology. The fascia orginates from the medial calcaneal tubercle and courses distally to insert onto the plantar plates of the metatarsophalangeal (MTP) joints and the base of the proximal phalanges. The fascia is deep to the subcalaneal fat pad but superficial to the 1st plantar layer containing the abductor hallicus, flexor digitorum brevis, and adductor digiti quinti. There are a number of proximate neurological structures that can also cause plantar heel pain. The medial calcaneal nerve arises from the posterior tibial nerve at level of the medial malleolus and supplies sensation to the plantar medial aspect of the foot. Just below the malleolus it bifurcates into plantar and calcaneal branches. The plantar branches on the sole of the foot run between the flexor digitorum brevis and the quadrates plantae in the plantar layers. The plantar branch splits into medial and lateral divisions and compression in this area can also be a cause of heel pain.

FUNCTIONAL ROLES

The plantar fascia has three important functional roles. First it helps attenuate ground reaction forces early in the stance phase of gait then provides a truss support to the medial longitudinal arch in midstance. During propulsion, the plantar fascia stabilizes the foot and arch via the windlass mechanism. The windlass mechanism is activated by toe extension during propulsion to put tension on the fascia and passively maintain the height of the arch.

ETIOLOGICAL CONSIDERATIONS

Many etiological factors have been associated with predisposing an individual to the onset of plantar fasciitis. The risk factor with the strongest evidence of correlation is obesity or high body mass index (BMI) particularly in non-athletic populations. Rano[39] recommended a BMI under 25 to reduce the risk and Riddle[41] showed that the risk of plantar fasciitis was increased by 5-6 times when the BMI exceeded 25.[41] My experience is that patients who have recently gained weight are also particularly susceptible (pregnancy might be a good example). The biomechanical explanation for this phenomenon can be explained by the fascia's truss support role. The plantar fascia is essentially a tie rod that connects at each end of the medial longitudinal arch. As body weight increases a greater superior vector load is applied to the arch. This load is then resisted by the plantar fascia's increased tension to prevent migration of the proximal and distal attachments.

Many musculoskeletal risk factors have also been associated with plantar fasciitis. While there is only moderate evidence to support this contention my experience is that both pes cavus and pes planus feet seem to be more susceptible to the problem. [21] The planus foot has perpetually increased tension on the fascia because of its pronated position while the cavus foot has an inherently tight, shortened fascia causing a bowstring like load.

Greater agreement is present ..

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Upcoming Course Schedule

Foot-Ankle Course
Sep 29-30, 2007 – Grapevine, TX

Cervical Course
Nov 3-4, 2007 – Grapevine, TX

Shoulder Course
Feb 16-17, 2008 – Grapevine
Apr 5-6. 2008 – Iowa City, IA

Lumbar Course
Mar 1-2 – Salina, KS
Mar 15-16, 2008 – Plano, TX
May 17-18, 2008 – Lawton, OK

Knee Course
July 12-13, 2008 – Grapevine, TX

Pilates Course
Aug 16-17, 2008 – Grapevine, TX

A detailed description of the course content and learning objectives is available at our web site — www.continuing-ed.cc

Plantar Fasciitis continued …

References

The full list of references can be found on our web site at http://www.continuing-ed.cc/PFreferences.pdf

with the association between gastrocnemius-soleus tightness and the presence of plantar fasciitis. Amis[2] found that 78% of patients with plantar fasciitis had at least a 5° limitation in ankle dorsiflexion range of motion (ROM). Riddle's study[41] found a 23 times higher risk for plantar fasciitis if dorsiflexion ROM was less than 0°. The theory behind this increased risk with Achilles tightness is that it holds the calcaneus in varus and limits pronation, or conversely, causes a compensatory substitution at the midtarsal joint to increase the availability of sagittal plane motion not afforded at the ankle.

The final musculoskeletal factor that may influence prevalence are restrictions in 1st MTP motion. Limitation in motion at this joint could upset the windlass effect during propulsion. Creighton and Olsen[15] showed a relationship between 1st MTP restrictions and the presence of plantar fasciitis but because of the study's retrospective nature it is impossible to know if this limitation is the cause or the result of the pathology. In a more recent study by Allen[1] they did not show a correlation between 1st MTP motion restrictions and plantar fascial symptoms but did note instrinsic toe flexor weakness as a common occurrence.

The last etiological factor to discuss is the patient's age. Groucho Marx once said *"time wounds all heels"*. While only a weak association has been demonstrated with increasing age[21] my personal experience is that this condition is much more prevalent in the middle-aged adult perhaps supporting the theory that the pathology is degenerative in nature. It may be that the collagen is more tolerant in youth and needs to be more significantly abused in training or activities to manifest the symptoms. In adult patients, Riddle[41] showed a 3.5 times increase in plantar fasciitis if the majority of the workday was spent in a standing position. For younger patients with a training …

- *continued on page 3*

Question of the Month

How do authors calculate the "number needed to treat" statistic in studies that try to predict the effect of an intervention?

B.E., PT - TX

An increasingly popular form of analysis in our literature is called Bayesian inference. This is a statistical methodology in which evidence or observations are used to infer the probability of a hypothesis's truth. This type of analysis can be very helpful to therapists when evaluating the practical implications of a particular intervention. To determine the ***"number needed to treat"*** value we must first calculate the risk reduction that is present.

Maybe the best way to demonstrate this type of analysis is with an example. In 2005, Mandelbaum, et al, published their findings in the

Am J Sports Medicine on the effectiveness of a neuromuscular and proprioceptive training program's ability to prevent ACL injuries in female athletes. Table 1 has their findings.

The group that received the preventative training program had 6 ACL injuries out of 1885 subjects. The control group with 3818 subjects had 67 injuries. Thus, the control group event rate was 67/3818 = .018 meaning 18 out of 1000 subjects tore their ACL. The training group's event rate was 6/1885 = .003; meaning only 3 out of a 1000 tore their ACL if they had participated in the training program. Now we can calculate the relative risk which is the experimental event rate divided by the control event rate or .003/.018 = .17. The relative risk reduction is 1 – this value (.17) which is = .83.

However, to calculate the number needed to treat we need to know the absolute risk reduction which is the risk in the control group minus the risk in the experimental group. In this case that would be .018 - .003 = .015. The number needed to treat is then defined as the inverse of the absolute risk reduction or in this case 1/.015 = 67. In other word the "number needed to treat" is an epidemiological measure that tells us how many subjects need to go through this training in order to prevent one ACL injury. Now that is a pretty powerful and self-explanatory statistic. Any coach could see the value in this intervention if they thought that they could prevent an injury from happening for every 67th athlete that went through the training.

Additionally you can calculate odds ratios which are another way of communicating the risk or benefit of an intervention. Odds ratios equal to one suggest no effect of the intervention but in this case you can see that the treatment group was about 5.5 less likely to suffer an injury.

Questions you would like addressed in a future issue can be sent to mulliganpt@tx.rr.com.

Table 1

	Treatment Group		Control Group
Group size, *n*	1885		3818
Injuries	6 *(a)*		67 *(b)*
Risk *(event rate)*	.003		.018
Relative Risk *(a/b)*		.17 *(c)*	
Relative Risk Reduction *(1-c)*		.83 *(d)*	
Absolute Risk Reduction *(b-a)*		.015 *(e)*	
Number Needed to Treat *(1/e)*		67	
Odds *(events/non-events)*	.0032 *(f)*		.0179 *(g)*
Odds Ratio *(f/g)*		.18	

Plantar Fasciitis continued –

error at the root of their onset it is wise to counsel against sprinting, uphill running, and avoidance of harder training surfaces.

PRESENTATION

Fasciitis patients are rather homogenous in their presentation. They often report a gradual, insidious onset and complain of a sharp heel pain at the fascia's origin. This symptom is most noticeable after prolonged non-weight bearing. Fasciitis patients often relate that the worst steps of the day are their first ones. This painful event usually subsides quickly with gentle activity but progressively returns and worsens as the day progresses. Activities of daily living that are particularly aggravating include stair climbing, walking barefoot, and plyometric activities such as running and jumping.

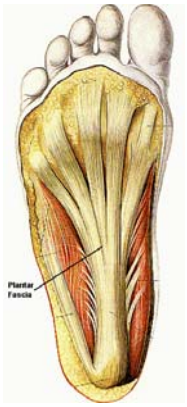
Common objective findings found during examination include varus malalingments, point tenderness at the fascial origin, decreased ankle and 1st MTP range of motion, and an altered gait pattern. Many patients will demonstrate a hypersupinated gait to avoid weight bearing pressure on the painful area and may have difficulty in performing a unilateral heel raise. The most predicitive provocation test is forceful great toe extension in standing position that reproduces the discomfort at the origin of the fascia. DeGarceau[16] reported 100% specificity and 31% sensitivity with this maneuver.

Many other conditions mimic plantar heel pain and the clinician must differentially diagnose the condition with a thorough history and examination. Plantar fasciitis is certainly the most common cause of heel pain but other conditions must be ruled out. Less common causes could be divided into neurogenic, soft tissue, skeletal, and systemic groups. Neurogenic causes may include the already mention calcaneal or plantar nerve entrapment or S1 radiculopathy. Soft tissue disorders that mimic fasciitis include calcaneal fat pad atrophy, Achilles tendinopathies, and subcalanceal bursitis. Common skeletal conditions that present in a similar manner include calcaneal stress fractures, Sever's disease (calcaneal apophysitis), Haglund's deformity, and bone bruises. Finally, one may need additional lab or medical work-up to rule out systemic causes such as Reiter's Syndrome, Ankylosing Spondylitis, Rheumatoid Arthritis, and Psoriasis.

The most common condition that mimics plantar fasciitis is tarsal tunnel syndrome. This condition is an entrapment of the posterior tibial nerve as it passes behind the medial malleolus. The patient usually presents with a burning or throbbing pain with paraesthias in the medial ankle and arch area. Tenderness may be present posterior to the medial mallelous and symptoms can sometimes be reproduced with a Tinel's tapping test. You may notice weakness of the interphalangeal flexors and a sensory deficit in the medial arch and medial side of the plantar surface of the foot. The best differentiation, however, is symptom location. Plantar fasciitis is most notable on the bottom of the foot while tarsal tunnel symptoms are more evident on the side of the foot.

Additional Resources:

Part II of this article in our next issue will focus on the evidence regarding the conservative management of this condition



"Featured Internet Link"

Center for Evidence-Based Physiotherapy

www.cebp.nl/

The CEBP is a Dutch organization whose mission is to search, collect and disseminate available scientific evidence in the physiotherapy domain for physiotherapists, health care workers, patients and financiers of health care. There web site contains over 1500 whitepapers, all freely available from their database. One of the most helpful resources is the clinical measurement instruments section under the "Tools" tab on the home page. This will take you to an extensive, alphabetized full text reprint of many of the most common functional outcome measurement forms.

The Reliability of the Cervical Exam

The purpose of our clinical examination is to uncover the underlying impairments and identify the pathology causing the condition. Unfortuntately, this finding does not always lead us to choosing the most desirable and effective intervention(s). Better luck has been found in the recent literature by selecting the intervention based upon the classification of the presentation into subcategories. In an article from Childs, et al, 2004, in the *J Ortho Sports Phys Ther*; he proposed a classification scheme for patients with neck pain that placed them into the following categories – mobility (limitation); centralization; conditioning (decreased) & exercise tolerance (limited); pain; and headache (cervicogenic origin) based on their examination findings. Treatment recommendations were then proposed based on the neck pain classification.

This approach requires that we have a reliable method for accurately classifying different varieties of neck pain. An article by Cleland last year in the *Arch Phys Med Rehab* addresses this specific need. The authors reported on the intertester reliability of both the history and physical examination in patients with mechanical neck pain. As you might have expected some of the tests and measurements had very high agreement from one examiner to the next while others were very low. Examination techniques that had reasonably high agreement were 1) responses to specific interview questions; 2) cervical ROM measurements; 3) centralization and peripheralization phenomena during sagittal plane motion; 4) muscle length assessment of the upper quadrant; 5) postural assessment; and 6) rhomboid strength. Areas that had lower reliability included 1) centralization and peripheraliztion phenomena during transverse or frontal plane motions; 2) lower trapezius/serratus strength; and 3) cervical/thoracic segmental mobility. This article is definitely worth a read. Cleland JA, Childs JD, Fritz JM, Whitman JM. Interrater reliability of the history and physical exam patients with mechanical neck pain. *Arch Phys Med Rehabil*. 2006 Oct;87(10):1388-95.

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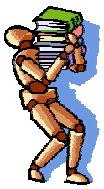

Dead Lifts

Rehabilitation Exercise Technique

"Every act of creativity is a sudden cessation of stupidity"

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The **Bilateral Bent Knee Deadlift** begins with the feet shoulder width apart. Lower the resistance by allowing the hips and knees to bend while maintaining a straight and neutral spine. The movement should cease if the torso begins to flex. The resistance should stay as close to the body as possible. The ascent should be a precise controlled extension of the hip and knees while keeping the torso-to-floor angle constant. This exercise recruits the gluteus maximus, hamstrings, and quadriceps.

The **Single Leg Stiff-Knee Deadlift**

This advanced exercise will isolate the hip and spine extensors (gluteus maximus, hamstrings, erector spinae). In this exercise the knee is maintained in a slightly flexed position and motion only occurs at the hip. Only bend over as far as you can maintain good spine alignment and balance. Monitor for any unnecessary frontal or transverse plane motion. The exercise is intended to be a sagittal plane movement involving extension of the hips while the spine and knee joints are held in place.

Featured Home Study Program

Lateral Ankle Instability

The Ottawa Fracture Rules

As our profession moves toward the 2020 vision of autonomous practice it is important that we are able to efficiently and accurately identify serious injury. Often ankle fractures and sprains present in a similar fashion but the Ottawa Fracture Clinical Diagnostic Rule can be applied so that we can assess the need for additional medical imaging before beginning our rehab process. This is an excellent screening tool because of high sensitivity and very low negative likelihood ratio. The rule is quite simple to apply and is graphically represented below but suggests that radiographic examination is required if the patient is unable to weight bear for at least 4 steps or has localized tenderness in one of four specific areas. If you are interested in learning more about the rehabilitation of ankle instability after a fracture has been ruled out you may want to look at our on-line home study entitled "Lateral Ankle Instability". This inservice can viewed or read free of charge. A post-test for CEU credit is available at http://www.continuing-ed.cc/homestudy.htm for a reasonable fee for clinicians licensed in Texas or Oklahoma.

Home Studies Now Available

Study and learn at your own pace at home!

Foot-Ankle Anatomy	.3 CEUs
Achilles Tendinopathy	.2 CEUs
Lateral Ankle Instability	**.2 CEUs**
Knee Meniscal Injuries	.2 CEUs
Orthopedic Hip Injuries	.2 CEUs
Goniometric Examination	.2 CEUs
Principles of Joint Mobilization	.2 CEUs
Functional Anatomy of the Shoulder	.3 CEUs
Scapular Significance: Ortho Perspective	.2 CEUs
Proximal Humerus Fracture Rehab	.2 CEUs
Examination-Treatment of Hand/Wrist	.3 CEUs
Ethics and Professional Responsibility	.2 CEUs

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