

# Shin Splints

## What are the symptoms of Shin Splints?

The common symptoms of Shin Splints include:

- \_ Aching
- \_ Pain
- \_ Swelling (severe)

The symptoms of Shin Splints usually start gradually and develop over the lower tibia.

## What are the causes of Shin Splints?

The main cause of Shin Splints is when the muscles on the front, outer and inner part of the shin are strained by overuse. This can happen during running or a sudden awkward movement like tripping.

Shin Splints are usually experienced by athletes who participate in sports such as running, football, tennis and rugby, ballet, figure skating, etc. and is frequently related to overuse in practices.

Another cause of Shin Splints is with people who have pronation or over-supination.

## Who do Shin Splints affect?

Shin Splints can affect people with biomechanical problems like over-pronation or over-supination. This is usually highlighted during repetitive weight bearing activities like, dancing, ballet, and figure skating where there is an emphasis on pointing the toes.

## Treatments for Shin Splints?

Upon feeling the symptoms of Shin Splints, a good treatment is to apply a cold wrap or pack to the shin to relieve pain.

The best treatment for Shin Splints is to try and identify the biomechanical causes of the pain and manage them to reduce the pressure on the area.

If pronation is causing Shin Splints, try a corrective orthotic device. If supination is causing the problem, then a shock absorbing insole may well be helpful.

## Additional treatment tips:

- \_ Always warm up and cool down and stretch thoroughly before and after taking part in any physical or sporting activity in order to reduce the risk of injury
- \_ Make sure you spend time strengthening the groin and thigh

muscles to improve your performance and reduce the risk of injury

- \_ Try to keep your body weight within normal limits for your height, as excessive body weight can aggravate hip pain caused by conditions like arthritis



## Without Support

The unsupported foot collapses, causing increased traction forces from the muscles of the lower leg on the periosteum.

The added traction causes small tears, inflammation, and pain in the shin area.

## Shin Splints Compression Wrap

<http://www.injurybegone.com/products/shinsplints.html>

**General Application:** Alleviates pain and discomfort associated with Shin Splints.

**Medical Application:** Reduces symptoms of Medial Tibial Stress Syndrome and Anterior Shin Splints.

**How It Works:** The Shin Splint Compression Wrap applies gentle pressure on soft tissue next to the tibia (shin bone), helping prevent additional tearing of the soft tissue away from the tibia. Compression not only reduces additional damage, it alleviates pain and enhances the healing process. In addition, targeted pressure will absorb stress to the tibia.

## Design Theory behind Shin Splint Compression Wrap:

Medial Tibial Stress Syndrome is the most popular form of shin splints. Because Medial Tibial Stress Syndrome occurs in the lower 1/3rd region of the tibia, it is important to target that region.

## Understanding what causes shin splints

<http://orthopedics.about.com/cs/sportsmedicine/>

The Shin Splint Compression Wrap's contoured design focuses compression on the soft tissue next to the tibia (where you need it) and keeps pressure off of the calf (where you don't need it). It can also be worn over the upper portion of the tibia to alleviate symptoms of Anterior Shin Splints. Includes Col Max covered Felt compression strip for additional support.

### **Understanding what causes shin splints**

<http://orthopedics.about.com/cs/sportsmedicine/a/shinsplint.htm>

By Jonathan Cluett, M.D., About.com  
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### **What are shin splints?**

The term shin splints is a common misnomer in sports medicine. It does not imply a specific diagnosis; rather it is the symptom of pain over the front of the tibia bone.

The pain from shin splints can be due to either problems of the muscles, the bone, or the attachment of the muscle to the bone. Therefore, 'shin splints' is simply the name given to pain over the front of the lower leg.

### **What causes shin splints?**

The symptoms of shin splints can be caused by several conditions. These conditions include:

- Medial tibial stress syndrome (the most common cause of shin splints)
- Stress fractures
- Exercise induced compartment syndrome

Shin splints are most commonly due to overuse. When the overuse causes irritation to the tendons and the attachment of these tendons to the bone, the condition is called medial tibial stress syndrome. This is what most people are talking about when they use the words shin splints as a diagnosis.

Medial tibial stress syndrome, or shin splints as most people call this problem, is commonly seen in athletes who suddenly increase their duration or intensity of training. This type of shin splints may also be seen in athletes who have very high demand training levels, such as marathon runners, even if their training levels are not dramatically increased.

### **Why are some people more susceptible to shin splints?**

Everyone has a different body, and each person's body mechanics differ slightly. One factor commonly implicated in causing shin splints is overpronation. Pronation occurs when the foot flattens out when weight is applied.

The normal foot should flatten slightly; meaning pronation is a normal foot motion. Overpronation occurs when the foot becomes too flattened out causing the foot to roll inwards. This can cause increased demand on the muscle over the front of the leg and lead to complaints of shin splints.

### **How is the cause of shin splints determined?**

As mentioned previously, the term shin splints is not actually a diagnosis, but a group of problems that causes a typical pain. Therefore, your doctor will perform a careful medical history and physical examination to determine the cause of the shin splints.

The area of maximal tenderness may be different in a patient who has different underlying problems causing shin splints. There are also provocative tests that can help determine the cause of the shin splints.

Patients with medial tibial stress syndrome typically have a dull, aching type of pain on the inside of their tibia bone. On examination, patients with medial tibial stress syndrome will often be tender over this same part of the tibia.

Patients may or may not have a small amount of detectable swelling over this part of the tibia. Some specific maneuvers, especially resisted plantar flexion (pushing down of the foot against resistance), typically causes an increase of symptoms.

In order to determine the underlying cause of the shin splints your physician may order an x-ray or a bone scan. The x-ray can detect fractures, and occasionally detect long-standing stress fractures.

The bone scan will detect areas of high bone turnover; these 'hot' areas indicate possible stress fractures or other bone problems. Patients with medial tibial stress syndrome may also have an abnormal bone scan, but there is usually a difference that can be detected to differentiate medial tibial stress syndrome and stress fractures.

### **What is the treatment for shin splints?**

Use the following general treatment guidelines if you are diagnosed with shin splints. It is important to note that the treatment of a stress fracture is not the same, and your doctor should evaluate persistent shin pain before you begin treatment.

- Apply ice packs or perform ice massage for up to 20 minutes, three times a day.
- Take an anti-inflammatory medication prescribed by your doctor.
- If you have a foot that excessively pronates, consider special footwear or orthotics.

- Perform rehabilitation exercises (low-impact) regularly. Swimming and cycling are excellent activities for an individual with shin splints. Try to avoid excessive impact while recovering.

### **How can I prevent shin splints?**

Prevention is best accomplished with smart training. If your sport involves high impact activities, make sure you have days that are low-impact (e.g. cycling or swimming) and no running. Increase the intensity and duration of exercise gradually.

When you are increasing your activity, perform more low-impact exercise in the beginning. Make sure you have proper footwear that has been replaced regularly (life span of most running shoes is about 500 miles or 6 months).

If you can run on grass or trails for some of your training (rather than pavement) that will also help prevent shin splints.

### **Treatment of Shin Splints:**

#### • **Ice An Injury**

Icing an injured body part is an important part of treatment. Icing injuries can be effective for sprains, strains, overuse injuries and bruises.

#### **How to properly ice your injury.**

- Icing is most effective in the immediate period following an injury. The effect of icing diminishes significantly after about 48 hours.
- Perform an "ice massage."
- Apply ice directly to the injury. Move the ice frequently, not allowing it to sit in one spot.
- Don't forget to elevate.
- Keep the injured body part elevated above the heart while icing -- this will further help reduce swelling.
- Watch the clock.
- Ice for 15-20 minutes, but never longer. You can cause further damage to the tissues, including frostbite, by icing for too long.
- Allow time between treatments.
- Allow area to warm for at least 45 minutes or an hour before beginning the icing routine again.
- Repeat as desired.
- Ice as frequently as you wish, so long as the area is warm to touch and has normal sensation before repeating.

### **Tips:**

#### **1. Ice Option 1 — Traditional:**

Use a Ziploc bag with ice cubes or crushed ice. Add a little water to the ice bag so it will conform to your body.

#### **2. Ice Option 2 — Best:**

Keep paper cups filled with water in your freezer. Peel the top of the cup away and massage the ice-cup over the injury in a circular pattern allowing the ice to melt away.

#### **3. Ice Option 3 — Creative:**

Use a bag of frozen peas or corn from the frozen goods section. This option provides a reusable treatment method that is also edible.

#### **4. Prevent Frostbite:**

Do not allow ice to sit against the skin without a layer of protection. Either continually move the ice (see "ice massage") or use a thin towel between the ice and skin.

#### • **Anit-Inflammatory Medication**

Nonsteroidal anti-inflammatory pain medications, commonly referred to as NSAIDs (pronounced en-sayds), are some of the most commonly prescribed medications, especially for patients with orthopedic problems such as arthritis, bursitis, and tendonitis.

These medications are available over-the-counter (e.g. Ibuprofen, Motrin, Aleve) or as a prescription (e.g. Celebrex, DayPro, Relafen). NSAIDs are effective at pain relief (analgesia), and to reduce swelling (anti-inflammatory).

#### **How do NSAIDs work?**

Medications that work to reduce inflammation come in two major categories:

- Steroids (e.g. Cortisone)
- Non-Steroidal Anti-Inflammatory Medications (NSAIDs)

Steroid drugs are a derivative of a natural hormone produced by the body. These medications can be given orally, systemically, or as localized injections, as is commonly used in orthopedics.

NSAIDs work to block the effect of an enzyme called cyclooxygenase. This enzyme is critical in your body's production of prostaglandins.

It is prostaglandins that cause swelling and pain in a condition such as arthritis or bursitis. Therefore by interfering with cyclooxygenase, you decrease the production of prostaglandins, and decrease pain and swelling associated with these conditions.

#### **Simple, right?**

Well, there's more to it. Prostaglandins also have other important functions in the body. One type of prostaglandin (there are many varieties) helps line the stomach with a protective fluid (called gastric mucosa).

When the production of this protective fluid is diminished, some people are at risk for developing stomach ulcers.

#### **What is different about the new NSAIDs?**

In the past several years, some newer medications have come on the market; these are commonly referred to as COX-2 inhibitors. Remember, all NSAIDs work against cyclooxygenase (COX).

Traditional NSAIDs (e.g. Ibuprofen, Motrin, Aleve) work against both COX-1 and COX-2. COX-1 and COX-2 are both types of cyclooxygenase enzymes that function in your body. The new medications (e.g. Celebrex) work primarily against COX-2, and allow COX-1 to function normally.

Because COX-1 is more important in producing the protective lining in your gut (gastric mucosa), these newer NSAIDs are believed to have less of a risk of causing stomach ulcers.

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That said, the newer NSAIDs have not been shown to work any better against the COX-2 enzyme. Therefore, the COX-2 inhibitors have the benefit of possibly having fewer side effects, but not necessarily better relief from symptoms.

### **What are the side effects of NSAIDs?**

NSAIDs can be obtained over-the-counter, but that does not mean they are without potentially serious side effects.

The most common side effect is irritation of the stomach. The cause of this is thought to be due to the effect on the stomach lining. If the irritation is severe, it may lead to bleeding ulcers, and potentially serious complications.

Before you start taking NSAID medications you should talk to your doctor. Be sure to let your doctor know about other medical problems you have, especially hypertension, asthma, kidney, or stomach problems. In addition, let your doctor know other medications you may be taking, and if you have any known allergies to medications.

NSAIDs should NOT be used if:

- You are pregnant
- You are breastfeeding
- You have a history of stomach ulcers
- You are taking blood thinning medication

NSAIDs should be used only under CLOSE physician supervision if:

- You have asthma
- You have liver problems
- You have heart problems
- You have kidney problems

### **Sources:**

Berger, RG "Nonsteroidal Anti-inflammatory Drugs: Making the Right Choices" *J. Am. Acad. Ortho. Surg.*, Oct 1994; 2: 255 - 260.

van Tulder MW, et al. "Non-steroidal anti-inflammatory drugs for low-back pain" *The Cochrane Database of Systematic Reviews* 2006 Issue 1.

### **More Information**

#### **Suggested Reading**

Osteoarthritis Bursitis Tendinitis

#### **Other Treatments**

Cortisone Injections, Icing to Reduce Swelling, Glucosamine & Chondroitin

### **Related Articles**

- What Is The Best Anti-Inflammatory Medication (NSAID)?
- Enteric-Coated Medication - What Is Enteric-Coated Medication?
- NSAIDs for Back and Neck Pain - What are NSAIDs?
- NSAIDs - The Facts of NSAIDs - Nonsteroidal Anti-Inflammatory Drugs
- Pain Medications for Dogs - Guide to Pain Medications for Dogs

- [Which NSAID is Best?](#)

Many patients are prescribed nonsteroidal anti-inflammatory medications for a variety of common orthopedic conditions including arthritis, tendonitis, and bursitis. These medications are particularly useful not only because they help decrease pain, but they also help control swelling and inflammation.

### **Are prescription NSAIDs better?**

NSAIDs are available both over-the-counter and as a prescription. It is very important to understand that while there are differences between prescription and non-prescription NSAIDs, these differences are not the strength or potential relief of symptoms. Many patients find their best response from over-the-counter NSAIDs.

There has been no study showing that newer NSAIDs (the so-called COX-2 inhibitors), prescription NSAIDs, or more expensive NSAIDs treat pain or swelling any better than more traditional NSAID medications. Most of the research evaluating the effects of NSAIDs has been done using over-the-counter ibuprofen.

## Why take different NSAIDs if one is not 'better'?

Often patients will experience a different response to different medications. This could be why some medications have helped your symptoms while others do not have a significant effect. This is not unusual, and it is difficult to predict which medications will most benefit a given individual.

The best way to determine which NSAID is best for you is to try different options. Often a physician will recommend one NSAID, and if adequate relief of symptoms is not obtained within several weeks of treatment, another NSAID can be tried.

One of the best reasons to consider some of the newer, prescription medications, such as Celebrex, is that these may be taken as once-a-day doses rather than three or four times daily. In addition the COX-2 inhibitors are thought to have fewer side effects on the stomach.

Because of the possible decreased risk of stomach problems, many doctors will recommend the COX-2 inhibitors for patients who may have risk factors for bleeding or stomach ulcers.

## Dr. Stephen M. Pribut's Sport Pages

<http://www.drpribut.com/sports/spshin.html>

### Shin Splints:

#### A Simplified Clinical Classification

by Stephen M. Pribut, DPM

Looking at a list of what's in and what's out: the term shin splints is out and the terms medial tibial stress syndrome, compartment syndrome and stress fracture or stress reaction are all in. Recently, the term shin splint was medically used to encompass almost all problems occurring in the lower leg.

These problems included both bone and soft tissue problems and those that overlapped. They were jumbled into several categories that poorly represented reality. The previous categories in use were anterior, posterior, medial and lateral.

Most athletes have used the term shin splint to refer to pain occurring either in the anterior or the medial portion of the leg. This correlates well with the type of problems that are most often clinically seen and will be discussed here.

Problems that occur in the lateral aspect of the leg are usually either fibular stress fractures or peroneal tendon injuries following an inversion injury of the ankle. Posterior leg pains are frequently injuries to the posterior muscle group at the myotendinous junction of the calf muscles and achilles tendon or early achilles tendonitis.

In this discussion we will not dwell on serious compartment syndromes, that topic will be saved for a later date.

## Medial Shin Splints

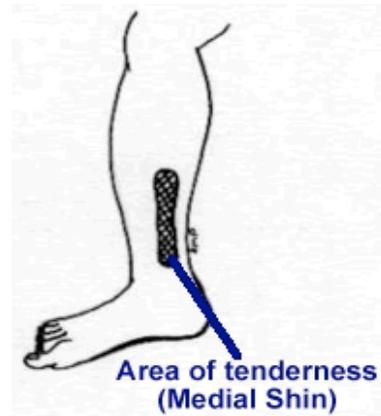
The outmoded term medial shin splints has been replaced by the term medial tibial stress syndrome. Either term is fine, since we do need a common language. But the term shins splint doesn't clarify what it is that actually hurts.

The pain in medial "shin splints" or medial tibial stress syndrome happens at the medial aspect of the leg, adjacent to the medial tibia in an area called the posteromedial border of the tibia.

Tenderness is usually found between 3 and 12 centimeters above the tip of the medial malleolus at the posteromedial aspect of the tibia. When the tibia is palpated (touched) the tenderness is not directly medial, but just behind the most medial portion of the tibia, in the mass of soft tissue that is there and at the bone itself.

Periostitis sometimes occurs in this location. The sore, inflamed structures usually include the medial muscles and tendons here. It was thought that the posterior tibial muscle was primarily involved, but anatomical dissections revealed that the soleus muscle and the flexor digitorum longus and flexor hallucis longus are located closer.

Some authors have written that traction upon the muscles or upon the fascia with attaches into the linea aspera of the fascia may be responsible for this injury.



"...the tenderness is not directly medial, but just behind the most medial portion of the tibia.."

## Medial Shin

Stress fractures can also occur in this area. The definitive test for stress fracture is a bone scan, but false negatives can occur and it is possible that a false positive might occur also, because of the soft tissue and periosteal involvement in this injury.

Clinically, physical examination can be used to differentiate between "medial shin splints" and stress fracture. With medial shin splints, (medial tibial stress syndrome, MTSS), the tenderness extends along a considerable vertical distance of the tibia. When a stress fracture is present, tenderness is usually noted that extends horizontally across the front of the tibia.

It is possible that eccentric contraction of the posterior tibial muscle will contribute to the pain here, although its origin is more proximal. This could occur as a result of the large strain forces that an eccentric contraction of the posterior tibial muscle would place on the bone in this region.

To conceptualize what is happening think of a piece of silly putty. If you pull it apart at the two ends, the part that has the most strain forces and clearly thins is the middle. Bone can change and has forces within it, so by a "stretch" of the imagination, it can be compared to silly putty. Strain occurs in bone, not at the point of pulling, but between the two areas that are being pulled.

### **Risk Factors**

The first risk factor is overtraining. Evaluate your schedule to determine what training errors you may have made. Mechanically, pronation is most likely to be the culprit. When the foot pronates the medial structures of the leg are stretched and put under stress, this increases the likelihood that they will become injured.

This long held view is being borne out by recent studies, which have shown increased signs of excessive pronation in those prone to posterior tibial tendon dysfunction (PTTD) (Tome 2006). Running on a canted surface, such as the side of a crowned road, can put the upper leg at risk to develop this problem, because the foot of the upper leg is functioning in a pronated position.

### **Self-Care**

Decrease training immediately. Do not run if pain occurs during or following your run. Non-weight bearing exercise may be necessary. Swimming, biking, and pool running can all be used to maintain fitness.

While running on soft surfaces has been recommended for this problem, that is not likely to help a pure MTSS. The foot is more likely to pronate excessively on mushy grass or sand. Packed dirt is ideal, and avoidance of concrete is also helpful.

In many cases shoes that are rated high for control of pronation may be helpful. Gentle posterior stretching exercises may help, but control of pronation is more directly related to the cause of this syndrome.

Ice applications following running may offer some relief, but are not curative. If symptoms persist it is important to seek professional medical attention.

### **Office Medical Care**

In office medical care will repeat some of the procedures that you have done. A thorough evaluation of your training schedule, racing schedule and shoes will be followed by a biomechanical evaluation.

Anti-inflammatory medication can be prescribed. The use of physical therapy modalities can also be helpful. I use electrical stimulation (HVGS) and ultrasound to treat this problem. I will also tape the foot to limit pronation and decrease the stress on the medial structures of the leg.

Pronation, which is a major contributing factor to this syndrome, in the long run, may be approached with improved shoes, and over the counter or custom orthotics.

### **Anterior Shin Splints**

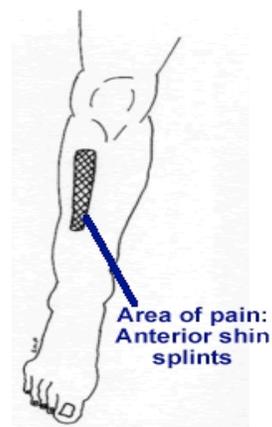
Anterior shin splints as a proper medical term has disappeared in the past 3 years. The concept of what shin splints are, was vague and wrong before, and is still not perfect. Nonetheless, symptoms may occur in the anterior lateral tibial region, that in the past were called anterior shin splints.

Now with the disappearance of that term, they are assumed to be either stress fractures or a form of compartment syndrome. Since we are going to be using a simplified clinical system we can cheat a bit and still use the term anterior shin splints. First let's try to find a clinical way to differentiate "shin splint" from stress fracture.

Most injuries that fit the term "anterior shin splint" are soft tissue injuries at the muscular origin and bony or periosteal interface of the bone and muscle origin. These usually have a longer more vertically oriented area of symptoms and tenderness.

The involved section of the upper tibia is usually 5 to 8 centimeters long and about 1 to 2 centimeters wide. Most injuries that clinically seem to be stress fractures have what is called a region of pinpoint tenderness and extend in a horizontal direction.

The tenderness can be identified as the existence of a discrete line of tenderness, not an exact shape. This line in many stress fractures of the tibia extends horizontally, but might take a tangential course through the tibia. With those that are horizontal there would be no tenderness found one or two centimeters above or below this discrete line of tenderness.



The non-stress fracture injury to this area may be due to micro tears of the muscle either at the origin or in the fibers themselves. This may occur because of repetitive traction or pulling of the anterior tibial muscles at their site of origin.

Repetitive loading with excessive stress, such as that caused by running on concrete, may also play a role in injury to this area. This may result in microtrauma to the bone structure itself.

Some have called the result of the repetitive loading injury and also the traction injury, a form of stress fracture. I usually reserve this term for a linear injury that is more within the bone itself. But, let's stay away from academic debates.

### **Anterior Compartment Syndrome**

One should be aware that a compartment syndrome can occur here. This is usually chronic and repetitive and in some respects different from the acute compartment syndrome seen after serious muscle injuries. It is vital to seek evaluation and treatment, if this is suspected. It is caused by the muscles swelling within a closed compartment with a resultant increase in pressure in the compartment.

The blood supply can be compromised and muscle injury and pain may occur. The symptoms include leg pain, unusual nerve sensations (paresthesia) and later muscle weakness. Definitive evaluation is done by measuring the pressure in the compartment with a catheter.

The normal compartment pressure is 8 to 10 mm Hg at rest. During exercise the pressure may rise to 50 mm Hg, but rapidly, within 5 minutes, should return to normal. It is clearly abnormal if the pressure exceeds 75 mm Hg during exercise or remains above 30 mm Hg after cessation of exercise. This may require surgical decompression of the compartment.

### **Runner's At Risk for Anterior Shin Splints**

The usual runners at risk for anterior shin splints are beginning runners. These runners have not acclimated to the stresses of running yet. They also may not have been doing an adequate amount of stretching. Poor choice of shoes and surface (i.e. concrete) can also play a role. Overtraining of course can be one of the factors in problems here as in most other running injuries.

The usual mechanical factors seen are an imbalance between the posterior and anterior muscle groups. The posterior muscles may be both too tight and too strong. The effect of too tight posterior musculature has ramifications for the gait cycle at two points.

The first time in which too tight posterior muscles have an impact on the anterior muscles is just before and after foot contact (heel for the distance runner). At this time the anterior muscles

(anterior tibialis, extensor digitorum longus, extensor hallucis longus) are functioning to slow up the forward and downward (plantarflexion) of the foot.

They are acting as decelerators. If the posterior muscles are too tight they will force the anterior muscles to work longer and harder in this deceleration. The second point in the gait cycle where the anterior muscles may work too hard is when the foot leaves the ground, at toe off.

The anterior muscles should be lifting up, or dorsiflexing, the foot as this time, so that the toes will clear the ground as the leg is brought forward. If the posterior muscles are too tight, the anterior muscles again will be working harder than they should be. Logically, downhill running will also have an adverse effect on the anterior muscles.

Repetitive impact on hard surfaces is another frequently associated factor. Excessive pronation may be a minor factor, but it is a much greater factor in the medial tibial stress syndrome (medial shin splints).

### **Key Causes and Solutions**

The key factors to correct will be:

- Tight posterior muscles
- Imbalance between the posterior and anterior muscles
- Running on concrete or other hard surfaces
- Improper Shoes - inadequate shock protection
- Overtraining

### **Self-Care**

Decrease training immediately. Do not run if pain occurs during or following your run. Non-weight bearing exercise may be necessary. The goal will be to find the distance, which can be run, if any, that does not produce symptoms.

The goal is not to find what your real limit is. Swimming, biking, and pool running can all be used to maintain fitness. Review your stretching and think about what good habits can keep you out of the doctor's office.

### **“Do not run on concrete!”**

The posterior muscles should be gently stretched, as discussed in my section on stretching. I recommend gentle stretching of the calf muscles and the hamstrings.

Shoes with too many miles on them should be replaced. Shock absorption should be a factor in selecting shoes in the individual with anterior shin splints.

Downhill running can aggravate this problem and should be avoided. Too long a stride can also delay healing. Most of all, DO NOT RUN ON CONCRETE!

After exercise icing can be done to lessen symptoms.

### **Office Medical Care of Anterior Shin Splints**

In office medical care will repeat some of the procedures that you have done. A thorough evaluation of your training schedule, racing schedule and shoes will be followed by a biomechanical evaluation.

A bone scan can be used, if necessary to evaluate for the possibility of stress fracture. A wick catheter test can be used, if necessary, to measure post exercise compartment pressure, if a compartment syndrome is suspected.

### **Anti-inflammatory medication can be prescribed**

The use of physical therapy modalities can also be helpful. To treat this problem I use:

- electrical stimulation (HVGS)
- a heel lift to reduce the pulling effect of tight posterior muscles.

While this does increase the distance the foot must be dorsiflexed, the duration of action and the effective strength of the posterior muscles is decreased.