

Changes in Treatment for Achilles Tendon Rupture

Research continues in the area of treatment for Achilles tendon ruptures. The last 10 years has brought a change from placing patients in a nonweight-bearing cast to using an ankle-foot orthosis (AFO) instead. An AFO is a brace usually made from plastic or light metal (carbon fiber). It allows for early weight-bearing. The question now is what's the best AFO design for this problem?

The Achilles tendon is a strong, fibrous band that connects the calf muscle to the heel. The calf is actually formed by two muscles, the underlying soleus and the thick outer gastrocnemius. Together, they form the gastroc-soleus muscle group. When they contract, they pull on the Achilles tendon. This action causes your foot to point down and helps you rise up on your toes. This powerful muscle group helps when you sprint, jump, or climb. Several different problems can occur that affect the Achilles tendon, some rather minor and some quite severe.

In severe cases, the force of a violent strain can rupture the tendon. The classic example is a middle-aged tennis player or weekend warrior who places too much stress on the tendon and experiences a tearing of the tendon. In some instances, the rupture may be preceded by a period of tendonitis, which renders the tendon weaker than normal.

Traditionally, this type of injury required a long period of time for healing, recovery, and rehab. Management with early weight-bearing is helping change that. And this study is contributing to the collection of knowledge we have about the effects of AFO designs.

Using 15 normal, healthy adults, the researchers compared three different AFOs with four different heel-wedge combinations. That gives a total of 12 different possible combinations. The heel wedge is used to place the ankle in a position of plantar flexion (toe pointed) in order to take stretch and pressure off the Achilles tendon while it is healing.

The goal is to find the position that protects the healing Achilles while still allowing function in order to avoid atrophy (wasting) of the gastroc-soleus muscle group. The benefit is to restore motion and strength faster and therefore allow the patient to return to daily (and sports) activities sooner with less disability.

A special in-shoe pressure system was used to measure the amount of pressure placed on the ankle and Achilles for each of the 12 combinations. A special tool called an electrogoniometer was used to measure ankle and foot range of motion while walking with each of the AFO designs/wedge angles. Each individual walked in their own shoes first then in the AFOs with various heel wedges.

They found that walking speed was affected by wearing a higher wedge (placing the ankle in more plantar flexion). Not surprising was the fact that motion (dorsiflexion, the opposite of pointing the toe) was restricted more with a higher wedge.

With smaller wedges, more dorsiflexion was allowed and more pressure was placed on the forefoot/less pressure on the heel. The more rigid AFO used in the study (a rigid rocker-bottom design) resulted in less pressure on the heel and more pressure on the forefoot.

In fact, the greatest heel pressures were measured when subjects wore the rigid rocker-bottom AFO. When this AFO was combined with the thickest wedge, there was more motion restriction than any other AFO/wedge combination.

This makes sense because the amount of load placed on the Achilles tendon, heel, and forefoot depends on motion at the ankle. When more dorsiflexion is allowed, force is transferred from the heel to the forefoot. Less dorsiflexion means less transfer of force from the heel to the forefoot so there is less pressure on the forefoot and more on the heel.

How does this all translate to someone who has a ruptured Achilles tendon? Remember, the people in this study all had normal Achilles tendons and no previous foot or ankle injuries. The authors say they can only "infer" how rehab of patients with acute rupture of the Achilles tendon would go.

Reducing ground-reaction forces and the degree of loading by using an ankle-foot orthosis with wedging is an important rehab strategy. Weight-bearing is allowed but in a protected mode. The foot and ankle are held in a plantarflexed position so the Achilles tendon can heal properly. If the ankle is dorsiflexed, the Achilles tendon is lengthened. Healing of the tendon in a lengthened position results in severe problems later.

One of the carbon-fiber AFOs used in these trials did not limit or restrict dorsiflexion enough so it would not be recommended for patients with acute Achilles tendon ruptures. The rigid-rocker bottom orthosis restricted ankle dorsiflexion the most but put a lot of pressure on the heel causing heel pain.

From this study, it looks like a carbon-fiber AFO with one heel raise would satisfy all needs. The ankle would be kept from too much dorsiflexion but still allow a near-normal walking pattern. This study does not answer the question of how much force is applied to the healing tendon with this configuration. And it is possible that each patient will have a different force tension the healing Achilles could handle.

This study does not answer the question of whether starting patients with three heel wedges and gradually reducing to one heel wedge is helpful. But the study does provide a starting point from which to begin evaluating actual patients. Finding the best rehabilitation protocol may take some time but it will be well worth the effort if it enables patients to return to full function sooner.

Reference: Rebecca S. Kearney, MSc, et al. In-Shoe Plantar Pressures Within Ankle-Foot Orthoses. In *The American Journal of Sports Medicine*. December 2011. Vol. 39. No. 12. Pp. 2679-2685.