Bicycle Injuries to the Foot & Ankle

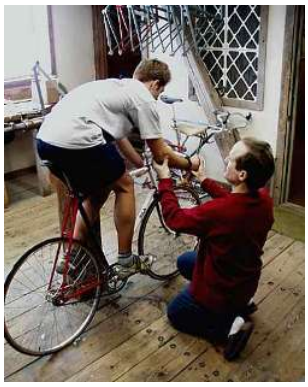
By Randy Smargiassi, DPM FACFAS

Azizulhasni Awang crashed during the 2011 Manchester World Cup, a large splinter from the wooden track skewered his leg. Mr. Awang remounted his bicycle and finished third.
www.dailymail.co.uk/news/article-1359081 (updated at 12:37 AM on 22nd February 2011)

The rider and bicycle work together as one, thousands of moving parts required to work efficiently. There are parts of the bicycle and body that should move and absorb forces and shock; then there are parts that should be rigid to transfer power & motion throughout the entire mechanism. When the cyclist and bicycle are fit properly the efficiency increases and flaws decrease - especially related to the foot & ankle.

Transfer of power through the core to hip-femur-knee-leg to ankle and foot to bicycle is paramount. Most cycling related problems from head to toe are a result of poor fit between bicycle and rider. The problems can range from neck & shoulder pain to wrist pain to saddle sores and back pain to hip, knee, and foot pain. One of the first signs there may be a problem with foot or leg position is when the inside of the cyclist's ankle hits the crank arm during pedal motion. This is usually due to poor cleat position or excessive foot motion or both. The foot & ankle is the primary transfer contact for power & efficiency of the body to transfer power to the bicycle. The strong core begins motion which is then transferred through the leg, foot, shoe, cleat, pedal, crank arm, chain and on to the rear wheel. Effective motion has a power value; the most enjoyable bicycle riding is achieved when motion is related to an efficient use of power. This holds true for any level from beginner, novice, recreational, and competitive cyclists. The power is lost by 'flaws' or in-efficiencies that are possible at any level. Even the most relaxing bicycle ride can be ruined by a bad position and low efficiency as related to power & motion.

The fit process by a trained professional



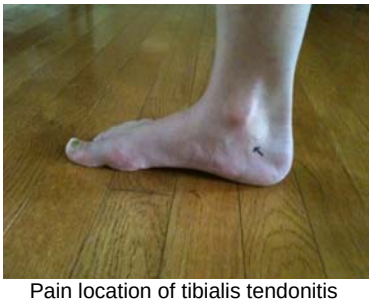
In this photo: Tom Kellogg of Spectrum Cycles

Initially considered in bicycle fit are the biomechanical properties of the rider. This may include isolated tight joints, short limbs, general flexibility, deformity, previous injuries or surgeries. The bicycle and accessory equipment can compensate for some problems - or exaggerate them if not functioning properly. Riding a bicycle without a proper or reasonable fit may exaggerate problems in many areas and make the experience less enjoyable. The ankle & foot have far more risk for trouble than the other areas due to the amount of small bones and small moveable joints. In regard to the lower extremity and foot, the most common mechanical problem is pronation - or too much pronation. When the bicycle has been fit and set up properly to the most efficient position, then foot motion is then considered and transfer of power from the leg through the foot to shoe and pedal can be its best. The fit between bicycle, foot, and body can then work efficiently in harmony.

www.ourhealthnetwork.com/conditions/FootandAnkle/Pronation.asp

The primary function of pronation motion is to absorb shock and which is a function of the foot. This pronation (or shock absorption) is needed initially in the pedal cycle, but required to become rigid during the down pedal stoke and transfer power. If pronation continues or is excessive, this may cause tibialis tendonitis, foot hot spots, blisters, callus, and arthritis. The most effective measure for problems caused by pronation in cycling is an orthotic made to match the shoe-cleat-pedal to the rider. The most effective pedal stroke is achieved when the foot is rigid in neutral position without excessive pronation during the down pedal stroke. The inside of the ankle should clear the crank arm by 10-15mm. If pronation continues during the down stroke of pedaling, there is loss of power through the foot mechanism. Pronation causes motion to be transferred in the frontal plane causing horizontal force rather than the optimal capital (vertical) force.

Severe pronation



Pain location of tibialis tendonitis

When the over-pronation occurs, the foot looses the rigid properties and continues to absorb shock. The continued motion causes the foot to move inside the rigid shoe creating friction and likely blisters or red irritations known as hot spots. Some hot spots can be painful and cause a cyclist to stop pedaling. A more serious problem is tendonitis. The tibialis posterior muscle and tendon are overworked during periods of over-pronation. This muscle is greatly overused and cannot function properly. The pain is to the medial ankle area, and continues even after cycling. The pain can be extreme, disabling, and result in the need for immobilization or surgery if not addressed early when symptoms first occur. A common presentation in serious tendonitis is a uni-lateral flatfoot and/or the inability to stand on the toes. In these severe cares surgery may be needed. Most others problems with tibialis tendonitis can be address with a biomechanical correction, an orthotic to reduce the over-pronation in the cycling shoes. If the tibialis tendon dysfunction is the major cause an orthotic can be made for everyday shoes as well. Orthotics for athletes are usually made of carbon fiber or composite materials, whereas an everyday orthotic can be made of plastic, carbon, or even cork material to provide the desired control. The orthotic is intended to be durable and last for several years. It is common for my patients to use an orthotic while walking as well as cycling for optimal tendon & foot function at all times.

The orthotic placed in the cycling shoe replaces the standard sock-liner and creates complete contact for the corrected foot to transfer the most energy possible to the bicycle.