

BAREFOOT RUNNING: RISKS AND BENEFITS OF A CURRENTLY POPULAR STYLE

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INTRODUCTION

Running is a key component to many athletic activities. It is generally an activity that comes naturally and most athletes may make minor changes in form but not radical changes. Over the years, changes to running form have been introduced with a recent resurgence in barefoot running coinciding with the popular book “Born to Run” by Christopher McDougall. Barefoot running or running with “minimalist shoes” is a hot topic of discussion among runners, running specialty stores, and the physicians who treat these athletes. This type of running provides many challenges and potential for injury but does have some benefits in regard to techniques to prevent form-related injuries.

The concept of barefoot running is one that obviously has been around a lot longer than running in specialty running shoes, which were developed in the 1970s. The advent of running shoes was based on the popularity of running and the advances in being able to evaluate running form. As more research occurred, the principles of shoe fit and pronation control were developed and have become the mainstay of the running shoe industry. New modifications are constantly being introduced based on research and the input of runners themselves. The pendulum has shifted many times over the years from focus on stability to focus



Figure 1. Notice the direct contact of the heel requiring the shoe to absorb shock in combination with heel contact pronation.

on minimal structure and back. Running shoes are tested in the design process, on treadmills, and then road-tested by runners themselves to determine how effectively they will prevent injuries and how the advances translate to running speed and efficiency. There are many factors that may contribute to running injuries and shoes can be one factor in this. The wrong shoe or a worn down shoes can create imbalances that result in increased stress on the body and subsequently injuries. The key to using running shoes is to have the correct shoes, but to also incorporate the proper form in combination.

ANALYSIS OF BAREFOOT RUNNING

Barefoot running is based on the concept of forefoot or midfoot strike during gait and limiting the traditional heel contact phase that occurs with running. Certain running populations, barefoot tribes, and cultures run while landing on the forefoot before the heel comes down or land in the midfoot with a flat type foot contact. These techniques have been utilized in various running styles (barefoot running, Pose, Chi running) and the principle incorporated into certain running shoe designs (Newton). The technique eliminates the immediate heel contact pronation and subsequent translation of force in the first 50 ms of gait directly proximal into the leg.

Studies have shown that when runners run barefoot versus with shoes they tend to contact in a flatter foot placement that reduces some of the stress of direct heel contact. The heel pad provides some degree of cushioning. The cushioning provided by running shoes distributes the force better due to the materials used in the heel cushion region as well as modifying how the foot progresses forward through the midstance phase of gait. Most of these studies were done on athletes who either traditionally ran with shoes versus those athletes who did not wear shoes to run as a routine. In comparing the force of impact of rearfoot strike runners and forefoot strike runners it is clear that impact is higher when contacting in the rearfoot (Figure 1). The

increased stress due to initial contact in the rearfoot is not the only causative factor of running injuries that is addressed by barefoot running.

The initial impact force has an effect on injuries as does how that loading force is dispersed throughout the gait cycle. The rate of loading of the foot is similar between runners who rearfoot strike with shoes and who forefoot strike without shoes (Figure 2). The rate is much higher in those who rearfoot strike without shoes, which means there is much more force translated through this region without the use of shoes to assist in shock absorption. The rate of loading relates to the absorption of energy as the foot contacts the ground, which occurs as the foot progresses into its midfoot stance. The rate of loading is likely similar between forefoot strikers barefoot and shoed rearfoot strikers. The difference comes in where the stress and shock is absorbed.

In traditional rearfoot strike, the shock is absorbed through pronation and the transfer of pressure from the rearfoot through the ankle and lower extremity. In forefoot strike, the shock is absorbed in the forefoot and by the Achilles tendon. Heel contact pronation with a controlled rate of progression can appropriately absorb shock and prevent continued problems. One of the key components of injury prevention is the rate of pronation and the translation of force through the foot, ankle, rotation of the tibia, and the effect on the knee and hip complex. The direct force from contact and how it is dissipated has an impact on injury potential but it is not the only consideration since the way the force is transferred throughout the gait cycle has an effect in combination.

Impact is not the only factor involved with running injuries. Videotape analysis of runners reveals that one of the most common causes of running injuries results from overstriding. Overstriding creates the same forces as contacting more on the heel as the body has to distribute this force very quickly. Forefoot and midfoot strike runners limit stride length through the form of their running and the fact that they tend to land with the foot in a relatively plantarflexed position at the ankle. This requires shortening the stride and results in less force transferred. Also fewer rotational forces through the midfoot and tibia and may in effect decrease running mechanics-induced injuries. The stride length change is a potential benefit of barefoot running and has shown to benefit athletes independent of shoe choice. This decrease in injury potential must be weighed against the risks of running barefoot or with a forefoot strike.



Figure 2. In comparison, the forefoot strike style demonstrated with shoes reveals the plantarflexed position of the ankle, which acts to absorb shock with foot contact.

RISKS OF BAREFOOT RUNNING

Running Surface

Anytime the foot is not protected, there is a potential risk for a puncture wound or damage to the foot from the running surface. This risk is very real especially if running on trails or uneven areas where rocks and plant/tree roots are a potential problem. One must also be careful of glass and other sharp objects as landing on the forefoot will drive anything further into the foot. Hot surfaces or running in cold weather can be potentially dangerous to the skin if no measures are taken to protect these structures. The use of minimal shoes to protect the feet should be considered to prevent potentially dangerous situations.

Forefoot Overload Conditions

Any time a running style is attempted that incorporates running on the forefoot, overload injuries must be considered. The foot contacts the ground and maintains a more stable configuration limiting the unlocking and distribution of weight that occurs with pronation. This results in the weight-bearing load being maintained in the forefoot. This may result in a stress fracture or a strain on the soft tissue structures in the forefoot including the plantar plate or sesamoid complex injuries.

Clinically, the most common injury related to barefoot running seems to be stress fractures. Many athletes who incorporate barefoot running into their training are often too aggressive in their approach and progression into this running style. This can be countered by starting out training on softer surfaces and for very limited amounts of time. It may be necessary to continue this progression gradually to ensure that stress fractures or other overload injuries do not occur.

Achilles Tendonitis or Calf Injuries

The forefoot strike running style creates increased stress on the Achilles tendon complex. As runners attempt to run barefoot and land on the forefoot or midfoot, there is a significant amount of strain placed on the posterior muscle group due to the load and release of the Achilles tendon with forefoot strike. Even with the initiation of walking barefoot or with minimalist shoes, there is a significant impact on the Achilles tendon complex. The change from traditional shoes (running, everyday, or dress) with a raised heel to the lack of heel lift with barefoot running places more stress on the Achilles tendon complex. It is important for the patient to incorporate calf stretching as a part of their daily routine in the development of this new running technique. Just as with preventing forefoot overload conditions, it is important to establish a gradual progression into barefoot running.

PREVENTING INJURIES WITH BAREFOOT RUNNING

Each of these risks is very real and must be considered by the athlete undertaking this new running gait and for the physician guiding the athlete. The risk of each of these injuries can be reduced by gradually incorporating barefoot running or forefoot strike running. Just as with any training program it is important to gradually introduce a new technique. The training should begin on a smooth level softer surface such as grass. The running pace should begin with walking, and gradually building to running on an every-other-day basis, so the body can adjust. While running, it is essential to focus on the forefoot contact technique to limit stress and allow for a shortening of the stride length. The increase in intensity and distance should be done with the traditional 10% rule of changing anything (pace, distance, topography) by only 10% per week, so as to not add additional stress to the body. This gradual progression will decrease the potential for injury that can occur with this non-traditional style of running.

CONCLUSION

Barefoot running is a technique that is not new but has had a recent rise in popularity. Various shoes and styles have been developed with the general principle of decreasing impact force by shortening the stride and landing on the forefoot or midfoot to accomplish these ends. The style does create the potential for injuries in that most athletes do not progress gradually into this new gait style and create overload or tension injuries. If used judiciously, the change in running style may have some benefits but only the test of time will determine its success. Most athletes will not see the benefits outweigh the risks but for those who desire to try, it is important they be guided in the gradual progression to this style of running. Time will tell if barefoot running is the latest fad or if the principles it has brought to the forefront will benefit athletes for years to come.

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