Prescribing Athletic Footwear and Orthoses: The Game Plan

Here's a systematic approach to making these important decisions.

American Academy of Podiatric Sports Medicine

BY MATTHEW B. WERD, DPM AND E. LESLIE KNIGHT, PHD

This is a continuation of a series of sports medicine articles, which were written by members, fellows, board members, and past-presidents of the American Academy of Podiatric Sports Medicine (AAPSM). The present article is excerpted from the textbook Athletic Footwear and Orthoses in Sports Medicine, edited by Matthew B. Werd, DPM and E. Leslie Knight, PhD.

The AAPSM serves to advance the understanding, prevention and management of lower extremity sports and fitness injuries. The Academy believes that providing such knowledge to the profession and the public will optimize enjoyment and safe participation in sports and fitness activities. The Academy accomplishes this mission through professional education, scientific research, public awareness and membership support. For additional information on becoming a member of the AAPSM please visit www.aapsm.org.

Introduction

This article is geared toward maximizing athletic performance and minimizing injury through the use of an appropriate prescription for athletic footwear and orthoses. Often neglected, overlooked, or misunderstood, this prescription should be the first step in the lower extremity treatment of the athlete. Overwhelming evidence is now available and has been presented which supports the use of custom foot orthoses in the athlete.

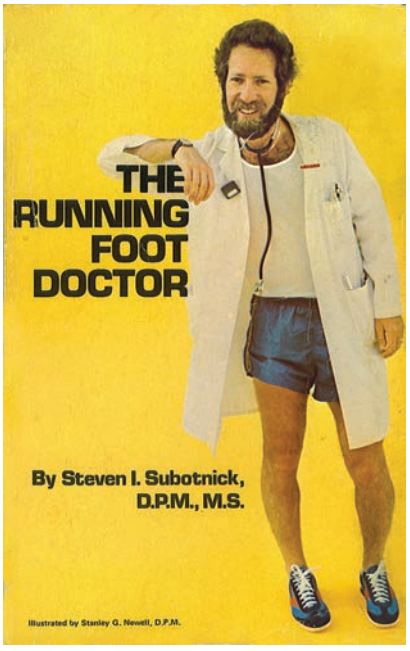

Figure 1: Dr. Subotnick shown on the cover of The Running Foot Doctor, published in 1977, when running shoe selection offered very few choices, features, or technology.

The authors present a systematic approach—the game plan—for prescribing athletic footwear and orthoses, incorporating all facets to ensure maximal effectiveness. A 15-point sequential guideline (see checklist on pg. 108), customized for each athlete, will be helpful in making decisions on athletic footwear; however, it is ultimately up to the sports medicine practitioner to choose which shoes or which orthotics devices are most appropriate for each individual athlete.

NOTE: *This article is intended as a presentation of the systematic approach; each component of the prescription for athletic footwear and orthoses is broken down and discussed in-depth in other chapters throughout our textbook.*

1) Determine the Foot Type

Foot type can be classified by the arch height, which will provide a starting point as to how the foot will function biomechanically during gait and which athletic footwear will be most appropriate. Historically, the "wet test" has been used as a quick and easy test for the lay athlete to determine arch type. A more contemporary and accurate determination of arch height and foot type can be made by either quantifying navicular drop or assessing the verti-

Continued on page 108

Game Plan *(from page 107)*

cal forces beneath the foot.

The three basic categories of foot types are: low arch (flat foot); normal arch; and high arch (cavus foot). In general, a low-arched foot is more flexible and will function with excessive pronation which will require additional medial support. A normal-arched foot will function with an appropriate amount of pronation and will not require additional medial support or excessive cushioning. A high-arched foot is more rigid foot and will function with limited pronation and will require additional cushioning and shock absorption.

Size of the foot must also be considered, as the foot size may affect proper fit of the shoe and may affect the choice of material and the size and thickness of a foot orthosis. Foot size can be categorized as large, wide, medium, small, or narrow.

2) Determine the Foot's Function During Gait

Gait evaluation is an important part of an athletic evaluation. Static examination of an athlete's foot type is a good starting point; however, a dynamic evaluation will provide more information on how the foot functions in real-time. Based on the dynamic function of the foot, a more appropriate recommendation can be made regarding the biomechanical needs of the athletic footwear and orthoses.

Clinical evaluation of the amount of pronation during gait can be subjectively assessed by visualizing the athlete walk and run; however, a more objective and accurate gait analysis can be performed using hi-tech video analysis and force-measuring platforms or in-shoe pressure-measuring technology.

The amount of foot pronation noted during gait can be excessive, increased, biomechanically efficient, decreased, or absent (supinated). Examination of an excessively pronated foot during gait will demonstrate an internally-rotated leg, an excessively everted calcaneus, a collapsing arch, and an excessively abducted forefoot.

It is important to observe—not necessarily *how much* excessive pronation occurs, but—*when the excessive pronation occurs* during the gait cycle.

A complete biomechanical examination should note any asymmetries starting at the head and progress distally to the shoulders, back, hips, knees and patella, legs, ankles, and feet. The amount of core strength and stability should also be noted, as a weak core may predispose a lower extremity injury.

Foot size may affect the choice of material and the size and thickness of a foot orthosis.

3) Consider Any Foot Pathology

Common foot pathology which may affect the choice of appropriate athletic footwear and orthoses includes (but is not limited to): posterior tibial tendon dysfunction, spring ligament strain, metatarsalgia, plantar fasciosis, calcaneal apophysitis, hallux valgus, hallux limitus, sesamoiditis, stress fractures, neuromas, sinus tarsi syndrome, lateral ankle instability, peroneal tendon pathology, tarsal tunnel syndrome, and Achilles tendon pathology.

4) Consider the Size and Weight of the Athlete

Physical size of the foot and the weight of the patient must be considered when recommending athletic footwear and orthoses. Shoe volume, width, and length must be adequate. Shoe and orthosis materials need to be

Continued on page 110

CHECKLIST:

Prescription for Athletic Footwear and Orthoses in Sports Medicine 15 Components

1) Determine the foot type
2) Determine the foot's function during gait
3) Consider any foot pathology
4) Consider size and weight of athlete
5) Consider the athlete's demands from their sport
6) Assess key features of the athletic shoe
7) Recommend athletic shoes
8) Recommend athletic socks
9) Recommend athletic shoe laces and lacing techniques
10) Recommend over-the-counter athletic shoe inserts
11) Recommend athletic shoe modifications
12) Referral for custom foot or ankle orthoses
13) Recommend athletic custom foot orthoses and modifications
14) Recommend athletic ankle foot orthoses and modifications
15) Follow-up re-assessment for possible modifications after wear-testing

Game Plan *(from page 108)*

sufficient to accommodate the athlete without breaking down prematurely.

5) Consider the Athlete's Demands from Their Sport

Each sport has its own set of factors which may affect the choice of appropriate athletic footwear and orthoses, including the types of movement necessary. For example, distance running requires straight forward heel-to-toe motion while tennis requires side-to-side and front-to-back movements on the ball of the feet.

Sport surface also needs to be considered, whether it is a smooth court, a grassy field, artificial turf, or hard concrete.

6) Assess Key Features of the Athletic Shoe

Technologic improvements to athletic footwear and orthoses are ever-changing and the sports medicine specialist needs to be aware of advances and trends. In regards to running shoes, very few choices, features, or technology were available during the early running boom of the 1970's—as evidenced by Dr. Subotnick shown in figure 1 on the cover of *The Running Foot Doctor,* published in 1977—while a virtual explosion of athletic shoes, options, and technological advances has occurred since.

There has been a shift in focus from using cushioned materials in the 70's and 80's, to using materials to help "control motion" in the 90's,—midsole materials are rated by durometer (hardness of material): the harder the midsole the more supportive the shoe—to a current focus on using materials in different locations within the shoe in order to help guide the foot through gait more biomechanically efficient.

The term "motion control" is ubiquitous among athletic shoe manufacturers when referring to a shoe which is produced to limit excessive foot pronation and is thus referenced in this textbook as well; however, it may not be the most appropriate term. An athletic shoe material or technology does not actually "control" the motion of the foot, but it may have the effect to guide the foot through a more biomechanically efficient pathway.

The term "preferred movement pathway" as proposed by Benno M. Nigg, Dr.sc.nat., Dr.h.c., and promoted by Australian sports podiatrist, and Academy Fellow, Simon J.

Continued on page 112

TABLE 1:

Objective Features of a Running Shoe

- Interior shoe volume
- Toe box width
- Seams and stitching
- Insole
- Last shape
- Forefoot flexibility
- Midfoot flexibility/stability
- Midfoot torsion
- Midsole cushion at heel lateral and medial
- Midsole firmness at heel
- Heel counter
- Heel contact shape
- Rocker sole
- Increased midfoot surface

TABLE 2:

75-point Rating Scale for Athletic Shoes

(*75* = maximum points possible, *5* = minimum points possible)

Maximum Motion Control = 60-75
Moderate Motion Control = 45-60
Mild Motion Control = 25-40
Neutral or Cushioned = 5-25

TABLE 3:

Example of Ratings for Running Shoes Scored in Each Category

(W = Multiple widths, M = One width, C = Curved-last, SC = Semi-curved last, S = Straight-last)

Shoe A: Total 75W/S (Maximum Motion Control)
Shoe B: Total 50W/SC (Moderate Motion Control)
Shoe C: Total 30W/SC (Mild Motion Control/Stability Shoe)
Shoe D: Total 20M/C (Neutral or Cushioned Shoe)

Game Plan *(from page 110)*

Barthold, BSc (personal communication) may better reflect the intended function of athletic shoes which are produced to improve the gait of an athlete whose foot functions with an excessive amount of pronation during key moments of the gait cycle.

Figure 2: Heel counter stability—Squeeze the heel to determine the amount of stability or flexibility.

Figures 3 A, B: Midfoot torsional stability (shank rigidity)—Twist the shoe while grasping the heel and forefoot to determine the amount of stability or flexibility. Midfoot rigidity is necessary for running footwear.

7) Recommend Athletic Shoes

Quarterly reviews of current athletic shoes are performed by the American Academy of Podiatric Sports Medicine (AAPSM) Shoe Review Committee (SRC) members. Athletic shoes are reviewed objectively, without any outside influence or bias. Reviews are categorized by their intended function and effect. The reviews are made available—without any fees or membership requirements—for sports professionals, athletes, and the general public on the Academy's website, www.AAPSM.org.

Although running shoes provide the bulk of the shoes which are reviewed by the Shoe Review Committee, most sport-specific shoes also are included. The sport-specific athletic shoe evaluation is based on a brief description and history of the sport, any necessary equipment, the demands on the lower extremity, available references and research, desirable design and construction features of the shoe, available shoes, specific shoe evaluation, shoe recommendations, a summary and final comments.

Rating athletic shoes can be a difficult task, but reviews can be validated by implementing a consistent, reproducible, and objective rating system. Mark Reeves, DPM, Fellow, American Academy of Podiatric Sports Medicine, deserves credit as the pioneer who—along with assistance from the AAPSM Shoe Review Committee—created and implemented the Academy's objective athletic shoe evaluation process.

Multiple features of the running shoe have been identified as being integral to proper foot function and comfort, some of which are listed in Table 1.

A 75-point scale (See Table 2) rates each shoe based on criteria listed in Table 1, which documents the shoes' effect on pronation in the foot. A shoe with a higher score indicates that the shoe has more motion-controlling features, and thus more suitable for an over-pronated foot. A shoe with a lower score indicates a shoe with less motion-controlling features, and thus more suitable for a less-pronated (more rigid) foot. Table 3 shows examples of running shoes scored in each category.

Three basic tests for features of motion control in an athletic shoe can be performed quickly by the astute specialist or athlete. Figures 2, 3, and 4 demonstrate the three basic tests that best define the stability and motion control in an athletic shoe. Assessing the shoes' heel counter stability, midfoot torsional stability (shank rigidity), and forefoot flexional stability can provide enough information to make an appropriate recommendation for or against the shoe.

The reviews are made available—without any fees or membership requirements—on the Academy's website, www.AAPSM.org.

8) Recommend Athletic Socks

Sport socks have evolved and many choices of materials, cushioning, and even sock length need to be considered, depending on the sport and application.

9) Recommend Athletic Shoe Laces and Lacing Techniques

Athletic shoe laces and lacing patterns are often not considered in the athletic footwear prescription, but should not be overlooked. Certain foot types and pathology may be improved by basic shoe re-lacing patterns, and shoe fit may be improved by using different shoe lace materials and lace-locking systems.

10) Recommend Pre-fabricated Athletic Shoe Insoles

Athletic shoe manufacturers invest very little technology in the inserts that come with shoes. Pre-fabricated athletic shoe insoles are helpful—in

Continued on page 113

Game Plan *(from page 112)*

addition to the appropriate athletic shoe type—when additional cushioning (soft), support (stable, with additional arch padding), or pronation-limiting features (more durable, with hard plastic shell) are required.

11) Recommend Athletic Shoe Modifications

Athletic shoe modifications can further enhance athletic shoe fit and function and should be considered for certain athletic conditions.

12) Referral for Custom Foot or Ankle Orthoses

Referral for custom foot or ankle orthoses is the next step to be taken when all of the above steps have not fully resolved the athlete's condition. Evidence overwhelmingly documents and supports the effectiveness of custom foot orthoses in sports medicine.

Figures 4 A, B: Forefoot flexional stability—Forefoot flexibility depends on both durometer of the midsole material and the depth of the flex grooves. Deeper grooves allow more flexibility of the shoe at the forefoot. The shoe should flex at the metatarsal-phalangeal joint, not further proximal through the midfoot.

13) Recommend Athletic Custom Foot Orthoses and Modifications

The type of custom foot orthoses prescribed is dependent on a multitude of factors. Custom foot orthoses have been proven to be an important adjunct in conservative care of the athlete, which function to decrease the risk of certain injuries and potentially enhancing athletic performance.

14) Recommend Athletic Ankle Foot Orthoses and Modifications

Ankle foot orthoses have been proven to be an important adjunct in

Continued on page 114

Game Plan (from page 113)

conservative care of the athlete. As with custom foot devices, the type of ankle foot orthoses prescribed is dependent on a multitude of factors.

Summary

Sports medicine specialists who are knowledgeable and comfortable in recommending appropriate athletic footwear and orthoses for their athletic patients will be providing the athlete with the greatest service.

Having a solid game plan for recommending athletic footwear and orthoses for each athlete will be helpful in making critical decisions on athletic footwear. The sports medicine practitioner must ultimately decide which shoes or which orthotic devices are most appropriate for each individual athlete. PM

Having a solid game plan for recommending athletic footwear and orthoses for each athlete will be helpful in making critical decisions on athletic footwear.

15) Follow-up Re-assessment for Possible Modifications After Wear-testing

After each step above has been completed, a follow-up assessment of the athlete should be made after an adequate wear-test to assess effectiveness and to make modifications or adjustments if necessary.

Dr. Werd is a Past-President of the American Academy of Podiatric Sports Medicine; he is the Team Podiatrist and guest lecturer on the medical staff at Florida Southern College, and he is a Fellow of the American College of Sports Medicine. Dr. Werd completed an AO International Fellowship in Trauma and Reconstructive Surgery in Davos, Switzerland. He is Chief of podiatric surgery at Lakeland Regional Medical Center.

Dr. Knight is a is an exercise physiologist, Fellow of the American College of Sports Medicine and the author of 35 books and 100 scientific articles. He has worked with the Egyptian and Chinese Olympic teams, and he frequently lectures nationally and internationally.