Continuing Medical Education

Management of Sports Injuries

The author re-visits Dr. Richard O. Schuster's philosophy.

BY JOHN MCNERNEY, DPM

Goals and Objectives

The goals and objectives of this CME are to acquaint the reader with the principles taught by Dr. R.O. Schuster at the New York College of Podiatric Medicine to manage running and podiatric sports injuries. After completing this CME you will:

1) Understand the role of equinus in the athlete, and the need for lower leg stretching.

2) Appreciate Schuster's concept of foot guidance via shoes, orthotics and flexibility to decrease the frequency of running injuries.

3) Gain insight into the orthotic design features that Dr. Schuster felt were needed to allow foot orthotics to control the running foot.

These concepts can be used by those who treat sports medicine injuries to lessen injury rates and speed recovery of injured athletes.

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*Following this article, an answer sheet and full set of instructions are provided.—**Editor***

Dr. Richard O. Schuster was one of the pioneers in the use of foot orthotics for podiatric sports injuries. He was emphatic that equinus was a major cause of lower extremity pathomechanics.[1] He recommended using running orthotics with heel lifts to combat this problem.

Schuster recommended using running orthotics with heel lifts to combat equinus.

Schuster recognized that stretching the calf could combat equinus, but experience taught him that athletes were not likely to stretch long enough, hard enough, or frequently enough to address and reduce the equinus. His

solution was to raise the runner's heel with a 1/8-1/4 inch heel lift. Often this would be incorporated into a foot orthotic designed for sports.[2]

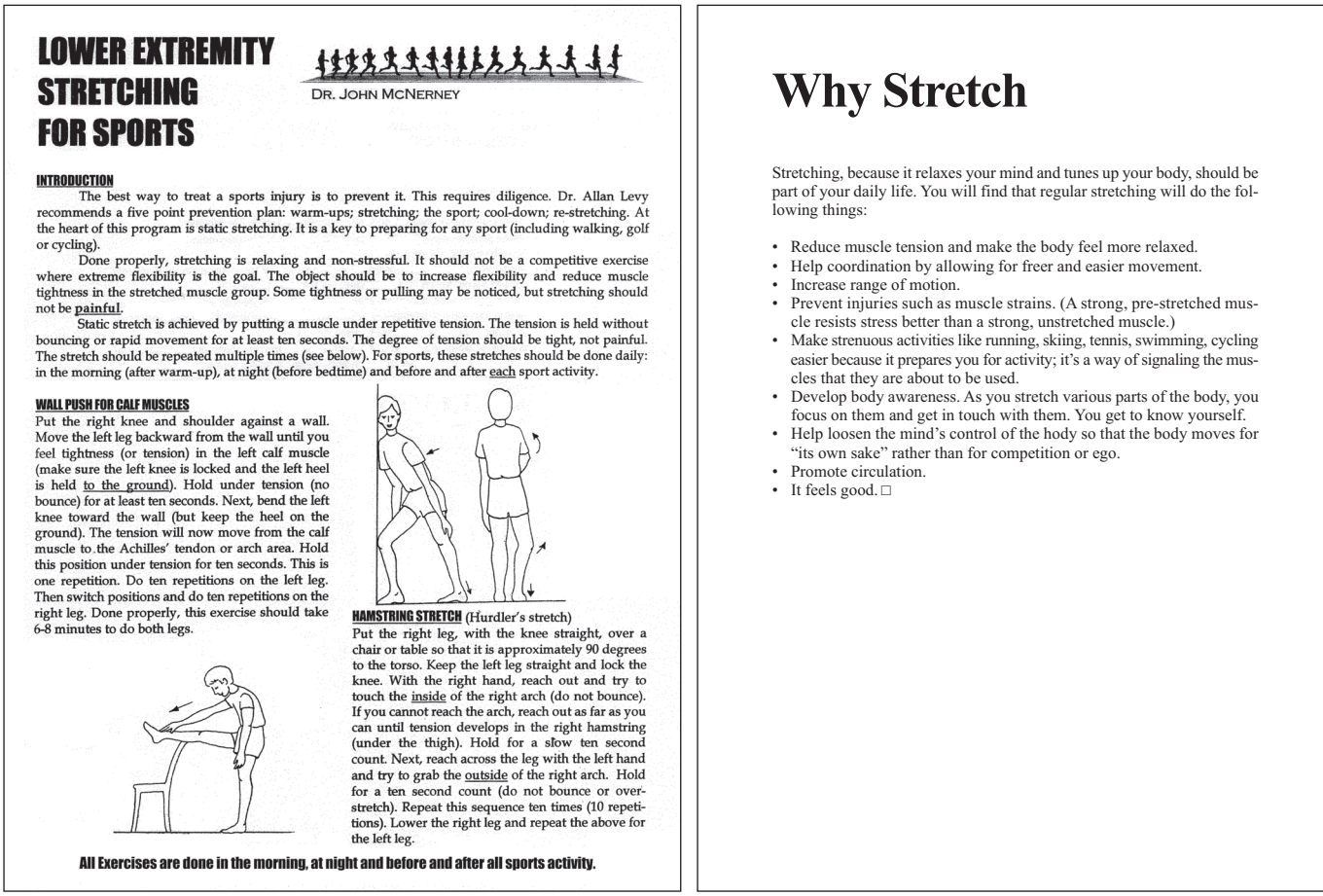
Most authorities in sports medicine today have a different viewpoint. Many high-caliber athletes, including professional, college, high school, or even weekend warriors, will stretch if properly motivated.[3] They need a valid reason, encouragement, and proper instruction. Hand-out sheets, verbal instructions, demonstrations, and motivational follow-up visits at three to six-month intervals are all helpful in providing this encouragement (Figure 1).[4]

Emphasis on increasing flexibility and follow-up are essential. Those of us who practice sports medicine believe in personal observation of athletes' stretching techniques to ensure compliance and proper execution. Emphasis on increasing flexibility and follow-up are essential to success.[4] Not many athletes will comply unless they are motivated and see tangible results.

Because results can take time to occur (6-8 weeks, or longer), are subtle, hard to measure, and do not result in profound performance changes, athletes often give up before proper flexibility is achieved.[3] This becomes our primary challenge. Experience shows that Schuster's recommendation to incorporate a heel lift in orthotics for athletes may be counter-productive and lead to calf muscle (gastroc-soleus) contracture. It can often cause an increase in the equinus.[5] This occurs when heel-lifted orthotics are used during activities of daily living and sports over extended periods of time. One need only observe older women who have a lifetime of wearing high-heeled shoes as their primary footwear to confirm this anecdotal fact. Many of these women admit to discomfort walking barefooted or in shoes that do not raise the heels.

Static stretching is the most rational routine for the non-professional or weekend athlete to achieve and maintain flexibility.

It has long been held and recently confirmed that static stretching is the most rational routine for the non-professional or weekend athlete to achieve and maintain flexibility.[4-6] Recommended protocols are a gentle stretch, with the calf under moderate tension for either three repetitions held for 30 seconds, or 10 repetitions



LOWER EXTREMITY STRETCHING FOR SPORTS

DR. JOHN MCNERNEY

INTRODUCTION

The best way to treat a sports injury is to prevent it. This requires diligence. Dr. Allan Levy recommends a five point prevention plan: warm-ups; stretching; the sport; cool-down; re-stretching. At the heart of this program is static stretching. It is a key to preparing for any sport (including walking, golf or cycling).

Done properly, stretching is relaxing and non-stressful. It should not be a competitive exercise where extreme flexibility is the goal. The object should be to increase flexibility and reduce muscle tightness in the stretched muscle group. Some tightness or pulling may be noticed, but stretching should not be painful.

Static stretch is achieved by putting a muscle under repetitive tension. The tension is held without bouncing or rapid movement for at least ten seconds. The degree of tension should be tight, not painful. The stretch should be repeated multiple times (see below). For sports, these stretches should be done daily: in the morning (after warm-up), at night (before bedtime) and before and after each sport activity.

WALL PUSH FOR CALF MUSCLES

Put the right knee and shoulder against a wall. Move the left leg backward from the wall until you feel tightness (or tension) in the left calf muscle (make sure the left knee is locked and the left heel is held to the ground). Hold under tension (no bounce) for at least ten seconds. Next, bend the left knee toward the wall (but keep the heel on the ground). The tension will now move from the calf muscle to the Achilles' tendon or arch area. Hold this position under tension for ten seconds. This is one repetition. Do ten repetitions on the left leg. Then switch positions and do ten repetitions on the right leg. Done properly, this exercise should take 6-8 minutes to do both legs.

HAMSTRING STRETCH (Hurdler's stretch)

Put the right leg, with the knee straight, over a chair or table so that it is approximately 90 degrees to the torso. Keep the left leg straight and lock the knee. With the right hand, reach out and try to touch the inside of the right arch (do not bounce). If you cannot reach the arch, reach out as far as you can until tension develops in the right hamstring (under the thigh). Hold for a slow ten second count. Next, reach across the leg with the left hand and try to grab the outside of the right arch. Hold for a ten second count (do not bounce or overstretch). Repeat this sequence ten times (10 repetitions). Lower the right leg and repeat the above for the left leg.

All Exercises are done in the morning, at night and before and after all sports activity.

Why Stretch

Stretching, because it relaxes your mind and tunes up your body, should be part of your daily life. You will find that regular stretching will do the following things:

- Reduce muscle tension and make the body feel more relaxed.
- Help coordination by allowing for freer and easier movement.
- Increase range of motion.
- Prevent injuries such as muscle strains. (A strong, pre-stretched muscle resists stress better than a strong, unstretched muscle.)
- Make strenuous activities like running, skiing, tennis, swimming, cycling easier because it prepares you for activity; it's a way of signaling the muscles that they are about to be used.
- Develop body awareness. As you stretch various parts of the body, you focus on them and get in touch with them. You get to know yourself.
- Help loosen the mind's control of the body so that the body moves for "its own sake" rather than for competition or ego.
- Promote circulation.
- It feels good. □

Figure 1: Sample hand-out sheet to teach proper stretching technique

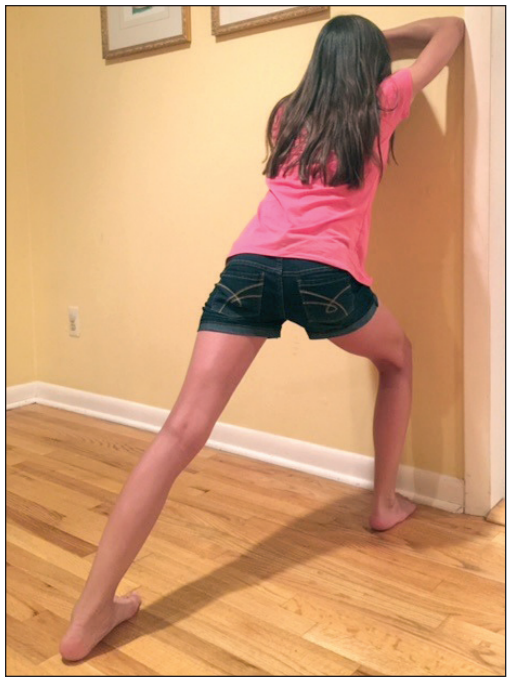


Figure 2: Shows calf-stretching with the knee extended (straight leg) stretch. The athlete should feel a gentle pull or stretch in the gastrocnemius part of the calf muscle.

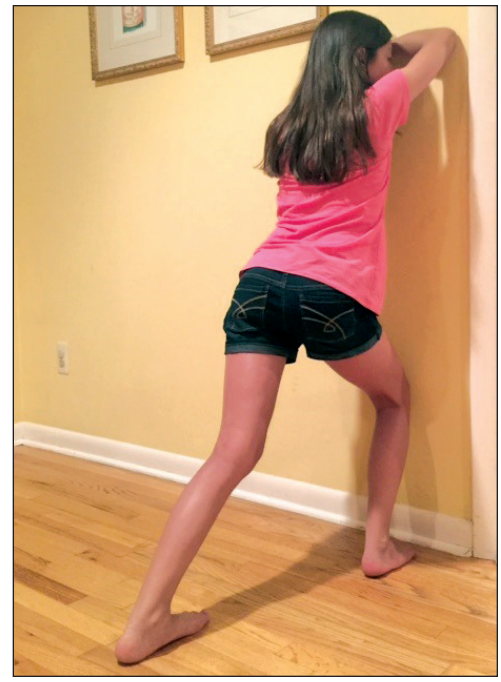


Figure 3: Shows calf-stretching with the bent leg. The heel is pressed to the support surface, and the knee is bent (flexed). The athletes should feel tension in the soleus part of the calf.

for 10 seconds. This protocol is repeated with the knee locked (extended) and bent (flexed) (Figures 2 & 3). This allows both the gastrocnemius and soleus portions of the muscle to obtain a proper stretch.

Buddy Stretching

PNF or proprioceptive neuro-facilitated stretch (buddy stretching) is accepted to be more effective than static stretch.[6] This technique is often used in professional sports. Unfortunately, this type of stretching is difficult to teach and usually requires a trainer, therapist, or a skilled partner to do without risk of injury.[6] Yoga and developmental-type stretching fall into the same risk category when done by poorly trained or more zealous athletes.

Orthotics and Shoes

Schuster recognized that equinus was only one cause of sports injury. In fact, he held that varus of the foot, ankle, and lower leg and leg length discrepancy were problematic as well.[1] He taught that varus of the foot, ankle, and lower leg was the most destructive force of all.[1]

He recommended the use of properly constructed running orthotics in a well-designed shoe to neutralize these forces.[7] If a limb-length inequality was seen, a heel lift of the proper height was added to the short side (usually about one half the measured amount). There is little written evidence of what Schuster felt was required in a good running shoe. This may be because during much of his early career in the 1950s-1970s, there were few choices. In fact, what constitutes a properly constructed shoe has changed numerous times over the last 50-60 years.[8]

During the "running boom" in the 1970s-1980s, control of rear foot motion was emphasized. In the 1980s-1990s, highly cushioned shoes were in vogue. Lightweight shoes in the 1990s gave way to minimalist shoes that are currently in fashion.[8] What this should tell us is that the "ideal" shoe may be determined more by fashion than function. Schuster hinted at this years ago by saying that even the best orthotic needed a "good" shoe to be effective.[2,7] He recommended that shoes should help limit pronation, but that the proper shoe/orthotic combination was tricky. He noted that complete elimination of pronation was unwise.

Current knowledge of what constitutes a good running shoe is more defined. Still, there is no true agreement on criteria. Choice is very individualized and often based on a myriad of ever-changing conjecture about foot type, running form, performance, pseudoscience, and quest for style. Most practitioners in sports medicine today suggest proper footwear for different sports and often give hand-out lists. (Figure 4)

According to Schuster, the major causes of athletic injury were equinus and lower leg varus and limb-length discrepancy.

Schuster was quite clear about what running athletes required in an orthotic (Figure 5).[1,2,7] First, materials used in construction of athletic devices should be made of compliant materials that would not "bottom out". He expected the shell of the device to support the long arch and limit navicular drop (limit pronation) from heel strike to push off, but not allow supination to occur too rapidly.[7]

It was Schuster's opinion that rigid materials like those used in Root-type orthotics caused "arch avoidance" and encouraged early

re-supination. Schuster further claimed that running athletes had little to no heel strike, propelled from the forefoot, and required foot guidance throughout the push-off phase of running. His orthotic design did not rely on rearfoot posting, but required extended posting in the forefoot.[7]

Posting for Running Athletes

Schuster maintained that forefoot posting for running athletes should start behind the metatarsal heads and extend to the toe sulcus. This allowed the device to be active throughout the running cycle. Today, we understand that Schuster designed orthotics that work more on tissue stress-reduction (controlling lower extremity overload), rather than trying to maintain subtalar joint motion as suggested by Root.[9] His design required appropriate rearfoot and forefoot angulation to the ground to maintain a stable foot position from late heel contact through propulsion in running.

Schuster maintained that running orthotic design should have a compliant shell that would not "bottom out".

This was accomplished by using posts or shims made from the same type of compliant non-rigid materials used in the shell. He called his orthotics "runner's moulds", and they were classified as semi-flexible or semi-rigid in the shell.[7] They had minimal to no rearfoot posting, were perfectly contoured through the long arch, and had appropriate varus or valgus posting through the forefoot to the toe sulcus.

Orthotics for Injury Treatment

Schuster maintained that orthotics could be used in treatment of many major foot and foot-related injuries.[10] The goals he listed for the use of running orthotics were:[1,2,7,10]

- Cupping and cradling the heel bone to prevent excessive heel inversion or eversion.
- Using a rearfoot post, not to control rearfoot varus (RFV) but to prevent excessive shear or torque.
- Cupping or cradling the calcaneus with a deep heel seat (16-18 mm in deep) to prevent side-to-side roll.
- Controlling the navicular drop (prevent arch sag) by support of the midfoot. It would also slow and minimize over-pronation of the foot and ankle. This was accomplished by bulk fill under the arch with compliant materials.
- Encouraging a timely re-supination prior to the propulsive phase of gait.

Figure 4: This a properly-constructed running shoe. The main elements are a cushioned midsole, a stiff heel counter, torsional stability through the arch, flexibility in the forefoot but minimal compressibility in the arch.

Figure 5: Shows two types of running orthotics. On the top is a cork and leather semi-flexible orthotic with rearfoot and extended forefoot posting (Schuster "runners mould"). At the bottom is a semi-rigid orthotic with an acrylic shell and with rearfoot and extended forefoot posting. Both types of orthotics are designed for sports use.

Schuster said that running orthotics must have forefoot posts that continued to the sulcus.

- Constructing orthotics for runners from more compliant materials that could give without bottoming out to provide foot guidance and support in non-rigid materials.
- Maintaining the foot to lower leg alignment through the entire running cycle from early contact to late propulsive stages of running. This requires the use of extended forefoot posting (shims) made of materials similar to those used in the arch.

Schuster held that running orthotics should be made over a positive plaster cast model of the foot.[7] The foot impression was used as a last over which the orthotic was made. He felt that the contours of the foot could be captured using semi-weight-bearing or non-weight-bearing techniques.[2,10]

Schuster's concept of a "runner's mould" required extended forefoot posting.

Summary

Schuster felt that orthotics were a useful tool in combatting running injuries when properly constructed and wisely used. He taught that alone, they were less effective than when they were placed into good shoes. He knew that equinus was a major destructive force on the running leg and recommended heel lifts be added to running orthotics to combat this deformity. Time has shown that many of Schuster's observations and treatments were correct, and many are still widely used today. **PM**

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CME EXAMINATION

1) Schuster taught that equinus was a major cause of sports medicine injury in the lower extremity; his remedy was:

- **A) Stretching**
- **B) Better shoe selection**
- **C) Restrict activity**
- **D) Use heel lifts**

2) Most authorities agree that lower extremity flexibility can be achieved by:

- **A) Modified activity**
- **B) Better shoe selection**
- **C) Static stretching**
- **D) Foot orthotics**

3) With a proper protocol stretch program, we should see better flexibility:

- **A) In 6-8 weeks**
- **B) In 6-8 months**
- **C) In 6-8 years**
- **D) Never**

4) The type of stretching that is most rational for athletes is:

- **A) PNF stretching**
- **B) Yoga stretching**
- **C) Developmental stretching**
- **D) Static stretching**

5) Stretching should be done with the knee extended and flexed to:

- **A) Stretch both the gastrocnemius and soleus muscles**
- **B) Take up more time**
- **C) Make coaches and trainers happier**
- **D) Enhance performance**

6) According to Schuster, the major causes of athletic injury were equinus and:

A) Leg length discrepancy and improper shoe choice
B) Lower leg varus and limb length discrepancy
C) Lower leg varus and minimalist shoes
D) Limb length discrepancy and hill training

7) Schuster maintained that running orthotic design should:

A) Have a compliant shell that would not "bottom out"
B) Have a rigid shell to control the arch
C) End behind the metatarsal heads
D) Have a long rearfoot post

8) Schuster said that running orthotics must:

A) Control the subtalar joint
B) Control rearfoot varus
C) Be rigid in the long arch
D) Have forefoot posts that continued to the sulcus

9) Which of the below are consistent with Dr. Schuster's running orthotic design:

A) Use compliant materials under the arch
B) Use rigid materials under the arch
C) Use extended forefoot posting
D) All of the above

10) Schuster's concept of a "runner's mould" required:

A) Rigid forefoot posting
B) Extended forefoot posting
C) No forefoot posting
D) Posting behind metatarsal heads

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(McNerney)

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