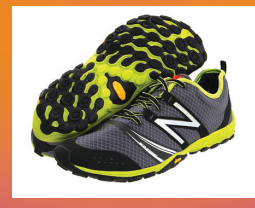
Continuing Medical Education

Selecting the Proper Athletic Shoe

The correct choice of footwear can enhance performance while preventing injury.

BY MARK A. CASELLI, DPM



Goals and Objectives

After reading this article, the physician should be able to:

1) Properly fit athletic shoes for various sports activities.

2) Know how to modify the lacing of athletic shoes to accommodate different foot types.

3) Recognize the signs of excessive wear of shoes used for different sports.

4) Understand the characteristics of a good sock for the athlete.

5) Recommend appropriate running, soccer, football, baseball, basketball, tennis shoes, and minimalist running shoes to athlete patient.

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*Following this article, an answer sheet and full set of instructions are provided (pg. 102).—**Editor***

Author's Note: *The reader may notice that some of the shoes pictured are not necessarily the latest or trendiest styles of Nike, Puma, Brooks, Reebok, or Asics athletic footwear. The purpose of this article is not to discuss the latest shoe styles but rather to inform the podiatrist about how to recommend athletic footwear for their patients. The recommendation should be based upon the elements of cushioning, stability, injury prevention, and enhanced performance. As such, we're recommending TYPES of shoes with certain characteristics; if more modern versions also fit the sport-specific needs of the athletic patient,then certainly they can be recommended as well.*

Athletic shoes are an important part of the equipment used by high performance athletes and play a significant role in the outcome of many events. Good shoes provide cushioning and stability and can prevent injury as well as enhance performance. Wearing the wrong shoes, ones not designed for the playing surface and condition, or those that do not fit properly, can lead to injury.

The clinician treating athletes must be familiar with the type of footwear used by the athlete patient since the wrong shoe might very well be the cause of that patient's problem. One study by NFL team phy-

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sicians and trainers looked at the performance of 15 different athletic shoes on grass and artificial turf under both wet and dry conditions. They concluded that wearing shoes under conditions for which they were not designed could lead to excessive forces and cause serious knee and ankle injuries.

Sport-specific, and even sport condition-specific, shoes should be used by anyone who participates in a sport for more than three hours per week. Even though well-made, sport-specific shoes have become relatively expensive, choosing the right shoe is important and is probably economical in the long run if frequent foot injuries can be prevented.

TABLE 1

Sport-Specific Shoe Fitting

Sport	Toe Area	Heel Area
Running	Allow thumbnail's length of space between the end of the longest toe on the largest foot and the end of the shoe.	Heel can slightly move but should not slip.
Soccer	Glove-like fit while standing up straight. Allow room for toes to move comfortably.	Snug fit with no movement.
Football	Allow room for toes to move comfortably while standing up straight.	Snug fit with no movement.
Baseball	Allow room for toes to move comfortably while standing up straight.	Snug fit with no movement.
Basketball	Allow thumbnail's length of space between the end of the longest toe on the largest foot and the end of the shoe.	Heel can slightly move but should not slip.
Tennis	Allow thumbnail's length of space between the end of the longest toe on the largest foot and the end of the shoe.	Heel can slightly move but should not slip.

General Considerations in Selecting the Proper Athletic Shoe

One of the most important aspects of selecting the proper athletic shoe is choosing the right size. Proper fitting sports shoes can enhance performance and prevent injuries. An ill-fitting shoe can be the root of many problems. Shoes that are too small are one of the major causes of foot pain, and those that are too large can cause blisters and lack of stability.

Not all brands of footwear fit the same. An experienced salesperson can be of great help. He or she can help fit shoes properly to address the athlete's concerns. A good salesperson would know which brands are cut wider in the forefoot or narrower in the heel. Your patients should have their feet measured each time they purchase shoes.

As one ages, foot size often gradually changes.

As one ages, foot size often gradually changes. The measurements should include sitting, standing, and heel to toe, heel to ball, and width. In spite of obtaining a number from the Brannock device, the actual fit on the foot is the most important consideration. The measurement itself is only a general guide. The athlete should be reminded that a properly fitting athletic shoe is often not the same size as a dress shoe. The right size running shoe is often a half to a full size larger.

Athletic shoes should be fitted at the end of the day, or after rigorous activity when the feet are their largest. Both feet should be measured since they are often different sizes and the shoes should be fitted to the larger foot. The shoes should also be fitted with the socks that will be used during the sports activity and with any special inserts or orthoses.

Wearing the wrong shoes, ones not designed for the playing surface and condition, or those that do not fit properly, can lead to injury.

Sports shoes for children should not be purchased with the thought that the next larger size will allow the athlete to grow into them. The exact size is most important. The shoes that are being tried on should be re-laced, beginning at the farthest eyelet with even pressure being applied as they are crisscrossed-laced to the top of the shoe. The shoe should fit with approximately 1/4 to 1/2 inch between the longest toe and the end of the shoe. It should have adequate room for the toes. The shoe should bend at the ball of the foot. If the heel to ball fit is off, then the break will not match the foot and it will create abnormal pressure and irritate the foot. The heel should be stable and not move in and out of the shoe. The shoes should be worn for at least ten minutes in the store. They should feel comfortable as soon as they are tried on. There is no break-in period. The most common error in purchasing athletic shoes, and one that cannot be corrected by padding, insole replacement, or orthotics, is buying a shoe that is too narrow in the toe box. Though these recommendations apply to the fitting

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of most athletic footwear, there are specific shoe fit variations for specific sports (Table 1).

Lacing System

The lacing system is an important part of the athletic shoe. It holds it all together by securing the shoe to the foot. Improper lacing can cause discomfort and injury. Pulling laces too tight cuts off circulation and may cause tendinitis on the dorsum of the foot. If laced too loosely, the shoes fit sloppily and result in foot and ankle instability. There are three types of lacing systems: variable width with staggered eyelets to adjust width, speed lacing with plastic D-rings, and conventional eyelets. Various lacing methods, other than the standard crisscross system, can be used to meet individual needs. A narrow heel, high or low arch, or a wide foot can be accommodated by changing the way the shoes are laced (Figures 1-4).

Worn-Out Shoes

Wearing worn-out shoes is a hazard in any sport. Worn-out shoes often result in aches and pains in feet, legs, knees and hips, signaling that it is time to replace the shoes. As a general rule, most running shoes provide cushioning up to 500 miles, though many runners may find breakdown in cushioning after as few as 350 miles. Shoes with compression-molded EVA mid-soles vary in durometer. This means that the cushioning elasticity and life span of each mid-sole is relative to the shoe. Most shoes with polyurethane mid-soles break down at a slower rate. To avoid injuries, it's a good idea to rotate running shoes every 200-250 miles, having two pairs of shoes to wear at all times. A running shoe's mid-sole cushioning may be worn out long before the tread shows signs of wear. Since the bottom and tread of the shoe may look fine, identifying when the cushioning is no longer effective is important.

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Press Test

The "Press Test" can be used for this purpose. When an EVA mid-sole is compressed, it creates visible lines or wrinkles in the mid-sole material that can be seen from the sidewall of the shoe. As the mid-sole is further compressed, the lines multiply and grow closer together. The first appearance of these lines indicates that the mid-sole is compressing normally. A simple pressure test can determine whether or not the mid-sole is compacted. Pushing the outsole upward into the mid-sole should show the mid-sole compressing into these lines. As the shoe breaks down, the mid-sole will compress less with the same amount of pressure. When the mid-sole shows heavy lines, and the press test yields a minimal degree of compression, the mid-sole has been compacted to a point where little or no cushioning remains.

Other Signs of Wear

Since most cleated athletic shoes have little or no mid-sole

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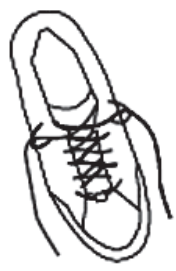

Figure 1: Lacing for Narrow Heel or Foot: Follow a normal lacing pattern up to the last pair of holes. For narrow feet, use shoes with staggered eyelets. Tighten from the outer eyelets, pulling the body of the shoe towards the center. At the last hole, tighten the laces and thread into the last hole without criss-crossing. Do not pull the laces all the way through, but leave a loop on each side. Cross the laces and thread them each through the loop on the other side before tightening and tying.

Figure 2: Lacing for Low Arches: Criss-cross lace the shoes as normal halfway up. Use the loop lacing the rest of the way.

Figure 3: Lacing for High Arches: Begin lacing as normal, criss-crossing and stopping after the first set of holes. Thread the laces straight up each side, criss-crossing only before threading the last hole.

Figure 4: Lacing for Wide Feet: Thread the laces through the first set of eyelets and then straight up each side without criss-crossing at all. Continue this way for two or three holes past the forefoot, and then begin criss-cross lacing as normal.

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material, the integrity of the heel counter, condition of the upper, and wear of the cleats must be evaluated. A shoe with noticeably "ground down" molded cleats should be replaced. Another way of determining whether a shoe should be replaced is by trying on a new pair of the model that is currently being worn. Compare this to the current shoes. If the new shoe feels much better than the old, then the old shoes are probably worn out. Heavy athletes and over-or under-pronators should check their shoes frequently since they tend to wear out their shoes quickly.

Socks

Socks are often overlooked as an important component of proper athletic footwear. Often, a poorly fitting sock or worn sock is one of the major causes of blisters. In general, socks that fit properly should provide ample toe room, have a well padded sole, fit snugly without wrinkles, and feel comfortable. In a longitudinal, double-blind study, the effect of sock fiber composition on the frequency and size of blistering events in long-distance runners was examined. It was found that socks composed of 100% acrylic fiber were associated with fewer and smaller blisters when directly compared to socks composed of 100% cotton fiber.

The tube sock has become popular over the last decade as one size generally fits all. Advising the athlete to wear two pairs of socks is another method of reducing friction and preventing hot spots that may become blisters. The inner sock is usually thinner and lighter than the outer sock. Lastly, clean socks are a must in warding off fungal growth and maintaining the overall health of the athlete's feet.

Resources

The practitioner treating athletes can obtain a great deal of information on athletic footwear by visiting athletic shoe stores, reading sports specific publications, and visiting the Internet. For example, *Runner's World* magazine publishes a "Shoe Buyer's Guide" four times a year. The American Academy of Podiatric Sports Medicine provides valuable information on selecting proper athletic shoes on its web site www.aapsm.org. These sources can be very helpful in guiding athlete patients to the sports shoe that meets their needs.

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Sport-Specific Shoes

Running Shoes

Getting a good pair of running shoes is the most important investment any runner can make. This is easy to understand when you realize that the only thing that separates the road from the runner are the shoes, each of them striking the ground about 800 times per mile with the force of about three times the runner's body weight. A properly selected running shoe can definitely decrease the number of running injuries. Each of the five major components of the running shoe: the last, outer sole, mid-sole, heel counter, and upper, should be considered in its selection.

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Last Shape

The shape of the last affects the shape, fit, flexibility, and stability of the shoe. The two basic shapes used for the last are straight and curved. A straight last has little or no curve from the heel to toe and provides greater support under the medial arch. A curved last turns inward from the heel to the toes. There are variations that include slightly curved (closer to straight) and semi-curved (closer to curved) last.

Lasting Techniques

There are three lasting techniques used in running-shoe construction: board, slip, and combination. In board lasting, the upper materials are glued to a fiberboard before they are attached to the mid-sole. Straight, board-lasted shoes aren't very flexible, but are firm and provide a good platform if orthoses are needed for excessive pronation. With slip lasting, the upper materials are stitched together and then glued to the mid-sole. This makes a lighter, more flexible shoe with a softer feel. Combination lasting uses the board method in the heel for stability and the slip method in the forefoot for flexibility. Many runners prefer combination-lasted shoes that provide some benefits of both types.

Treaded Outersole

The treaded outer sole is designed to resist wear, provide traction, and absorb some shock. It should not wear out quickly, and will often be in good shape after the shoes are discarded due to loss of mid-sole cushioning. The outer sole should wear primarily on the extreme outer edge of the heel and in the center of the ball of the foot. There are many sole designs, most providing adequate traction. In general, soles are either hard or soft. Harder soles are heavier, offer less cushioning, and wear longer. Softer soles are lighter, have more cushioning, and wear out faster.

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Midsole Construction

The mid-sole is located between the outer sole and the foot bed. It is the most important part of the running shoe. It absorbs shock, flexes at toe-off, and adds stability to the shoe. Mid-soles are constructed from various types of foams. Air-bags, gels, and other materials may also be inserted to increase cushioning. Their shock absorbing properties deteriorate with use. Studies have shown that mid-soles may lose a significant amount of their cushioning when exposed to running in cold temperatures.

Heel Counter

The heel counter stabilizes the shoe, and therefore, the foot. A rigid counter covering the entire heel is desirable, especially for pronators. It's usually made from plastic. Above the counter is usually a cushioned ankle collar, which provides protection and helps prevent Achilles tendinitis. A heel wedge, located above the mid-sole, adds height to the heel, increases shock absorption, and reduces strain on the foot and leg.

Shoe Uppers

Most running shoe uppers are either nylon, nylon mesh, or a combination. This creates a light-weight, breathable, washable, soft shoe that is comfortable and dries fast when wet. The mesh upper also makes the shoe cooler in the summer.

Considerations

When recommending a specific shoe, it is important to determine the runner's basic foot type and any running-related complaints and injuries. Running shoes come in three basic categories, those specializing in stability, motion control, or cushioning. If the runner has a medium-arched, semi-curved foot that properly pronates, then shoes that offer stability should be recommended. These shoes should have adequate mid-sole cushioning, as well as medial support.

A straight-lasted shoe with a hard heel counter and firm mid-sole offering motion control is best for over-pronators (Figure 5). These runners tend to have highly flexible feet with low arches and they often breakdown shoes on the inner borders. For under-pronators, those runners who have high, curved, rigid arches, curved-lasted shoes, which provide plenty of cushioning and a flexible forefoot, is recommended (Figure 6). These runners don't absorb shock well and are prone to lateral ankle sprains, stress fractures, shin splints and knee pain.

Soccer Cleats

Soccer is a game that is primarily played with the feet; therefore, the most important piece of soccer equipment is the footwear. A good pair of cleats, or boots, as they are sometimes called, is essential. There are variations of the basic soccer cleat designed for different skill levels, weather conditions, and field types.

Great care must be exercised in the selection of soccer shoes since each part of the shoe must serve a unique function. Players wear cleated shoes for better traction while running. Cleats give them increased speed and maneuverability.

The outsoles of the cleated shoe perform a dual function, providing both support and traction. Since the cleats often do not penetrate fully into the playing surface, a base of support is formed on top of the cleats. This condition is exaggerated on hard dirt. For this reason, cleated shoes should be selected such that the cleats along the shoe edges are positioned as close to the edge as possible. Sections of the sole without cleats will be relatively less supportive, especially in the mid-foot arch area.

Shoes with fewer cleats often include internal reinforcement. To accomplish this, a stiff synthetic or even a metal plate is added to the shoe to ensure adequate support. This practice has also been used in an attempt to reduce the incidence of "turf toe" on synthetic turf fields. The negative side-effect of this modification is a reduction of forefoot flexibility across the metatarsal heads which could result in irritation of the plantar fascia.

Traction is not desirable when it resists shoe rotation.

Figure 5: Straight lasted motion control running shoe for over-pronators.

Figure 6: Semi-curved lasted running shoe with gel enhanced mid-sole offering excellent cushioning characteristics.

Traction

The other function of the outsole is to yield adequate traction on a given surface. The two modes in which traction is desirable are along the length of the shoe and in resistance to lateral motion. Traction is not desirable when it resists shoe rotation. Fixing the foot against rotation has been cited as predisposing the knee and ankle to injury.

The best method of minimizing rotational fixation is to maximize cleat number and diameter, and minimize cleat height. In general,

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multi-studded models are preferred by most players (Figure 7). These can be worn both on grassy fields and on hard ground.

For rainy weather, screw-in studs are better because their length can be adjusted (Figure 8). The softer the field and the taller the grass, the longer the studs. The longer screw-in studs should not be used on synthetic turf, as they might get caught in the fibers and cause serious knee and ankle injuries. On synthetic turf, specially designed shoes with short studs are advisable. Since the feet and legs often end up in a tangle during the match, soccer cleats must be no less than 1/2 inch in diameter and may not project more than 3/4 inch from the sole.

Figure 7: Multi-studded soccer shoe with numerous molded cleats offering both good support and traction.

Figure 8: Soccer shoe with exchangeable cleats and studs that can be customized for different field conditions.

Shoe Upper

The main function of any shoe upper is to center the foot squarely over the base of support. In order to accomplish this, most soccer shoes have overlays along the lateral edge of the fifth metatarsal head and base, to serve as reinforcement and provide a stiff heel counter to anchor the rear-foot. A unique footwear requirement for soccer is to serve as an impact surface for the ball. To this end, extra stitching is placed along the medial and lateral sides of the shoe, which both reinforces the upper and forms a ball control surface.

Football Cleats

Football cleats are made both for the position played and the type of field played on. Football cleats come in three styles, or heights, to accommodate the varying needs of players by position. High-tops extend up the ankle to provide extra support, especially for lateral movements. Linemen benefit from this support because of the pressure put on their ankles by the numerous lateral movements during the course of a game. A mid-cut shoe offers good support while still allowing maneuverability. This style best fits the game of skill players; the defensive backs, running backs, wide receivers, and quarterbacks. Low-cuts are preferred by some players because they are lightweight. The lower cut provides extra maneuverability to allow for quick cuts on the field.

Cleats are either molded or detachable. Most are designed for either grass or turf fields. If games are played on both grass and turf, multipurpose cleats can be used. Molded cleats are permanently attached to the outsole on the shoes' bottom (Figure 9).

The main function of any shoe upper is to center the foot squarely over the base of support.

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Figure 9: Football shoe with molded studs offering both good traction for a variety of playing surfaces and durability.

Figure 10: High-top football shoe incorporating screw-in studs to deliver grip on very soft natural fields.

Figure 11: Metal spikes on baseball cleats offer good traction but can cause injury when sliding.

Athletic Shoe *(from page 96)*

Turf shoes usually use molded rubber cleats to give spring and traction on the harder turf surface (Figure 10). Molded cleats are generally less expensive than shoes with detachable cleats. Detachable cleats use studs that can be removed and replaced to fit field conditions on all types of grass, hard and dry, or wet and sloppy. Their versatility makes detachable cleats preferable for athletes who play primarily on grass. Shorter studs can be used for hard, dry surfaces and longer studs for a wet, sloppy field. Replacement cleats generally run from 12mm to 16mm in length. Having a variety of sizes gives the player more options for different field conditions.

Baseball Cleats

Baseball and softball are considered low to medium impact sports where approximately four to six times body weight is transferred to the feet. The impact can even be greater on artificial surfaces. Unlike soccer cleats, baseball cleats have a mid-sole to help cushion some of this impact. There isn't much repeated motion in baseball, but a lot of lateral (side-to-side) movement. Many players prefer a higher or mid-cut cleat to offer better ankle support. Baseball shoes are designed with either metal or molded cleats.

Metal cleats feature molded soles with several small metal spikes designed to provide maximum traction on the field (Figure 11). These are beneficial on extremely hard fields. The shoes are usually made of leather, have cushion mid-soles, and are fit much like a standard sneaker. Metal cleats are not permitted in Little League and instructional levels because of the potential for injury, happening most often when players with metal cleats slide into a base and the spikes are exposed. Molded cleats feature molded soles with several small plastic cleats (Figure 12). Molded cleats are most often used on Little League and instructional levels since they are significantly less dangerous than metal cleats.

Basketball Shoes

Basketball shoes must offer durability, support, stability, and shock absorption. The constant starting, abrupt stopping, high jumps, and quick side-to-side movements involved with basketball make these features absolutely essential in a shoe. Personal playing style is also an important factor in shoe selection. Power players will need shoes with maximum cushioning and stability. They may have to play with heavier shoes to get those benefits. The all-around player can use shoes with moderate ankle support and cushioning. There are many shoes to choose from in this category, and most are fairly lightweight. The fast player will prefer a lightweight shoe that offers moderate support, cushioning, and flexibility. Shoes with a lower cut are often desired by this type of player.

Basketball shoes must offer durability, support, stability, and shock absorption. The constant starting, abrupt stopping, high jumps, and quick side-to-side movements involved with basketball make these features absolutely essential in a shoe.

Understanding Construction

Understanding the construction of basketball shoes is essential in determining which features are most important for the player. The function of the upper part of the shoe is to keep the foot snug and securely in place during play. There are three shoe cuts available, high-, mid-, or low-tops. The majority of players, around 70 per cent, choose high tops for their ability to provide maximum ankle support (Figure 13). Power players and all-around players usually prefer the stability of this style.

For players who feel restricted in

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Figure 12: Only molded baseball cleats are permitted for Little League play.

Figure 13: High top basketball shoe offering both good ankle support and excellence for court traction.

Figure 14: Low cut basketball shoes, sometimes preferred by fast players, are light but offer less ankle support.

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high-tops, and who use speed as their greatest asset, mid-tops, which extend right to the ankle level, are their choice. Only about 10 percent of players wear low-tops for regular play (Figure 14). These shoes are lighter, but don't offer the built-in ankle support that high-tops do.

Uppers

All leather uppers have been replaced with lightweight combination uppers, mixing the stability and durability of leather with the breathability and flexibility of synthetic mesh. High-tech, all synthetic uppers, which are more durable than leather, are gaining popularity for their ability to offer stability in a super-lightweight material.

Closure System

A good closure system is necessary to keep the foot snug and secure in the shoe during the sudden stops and starts, frequent side-to-side motions, and quick turns encountered in basketball. Laces are an acceptable choice for keeping the foot stable in the shoe. Several manufacturers offer new lacing systems designed to offer greater stability. A good lacing system should lock the laces in place, making them less apt to loosen or untie, thus increasing stability during play. Some shoes feature a strap that wraps around the upper arch of the shoe to add more stability and protection against ankle rollover (Figure 15).

Figure 15: An in-shoe ankle support can be used to provide additional protection against ankle rollover.

Zippers are another choice for securing the foot in a basketball shoe. These are usually covered by some sort of protective material. Velcro, while good for younger players, is not reliable in terms of staying closed, and doesn't offer good support.

Most women should not buy men's basketball shoes. Men's shoes are built on a wider last than women's shoes and are generally too wide for a woman's foot, and do not offer an appropriate degree of stability.

Midsole

The mid-sole is often considered the most important part of the basketball shoe because the construction and the materials used will impact the levels of cushioning and shock absorption and can affect the players' ability to explode off the floor. The mid-sole is usually made of EVA, compressed EVA, polyurethane, or a combination of these materials. Proprietary cushioning technologies are also found in many brands of basketball shoes. EVA offers lightweight cushioning, but not as much stability and durability. EVA can be compressed to make it somewhat more durable. Polyurethane is a more dense and durable cushioning material. It can add stability to the shoe, but also adds weight.

Cushioning Technology

Proprietary cushioning technologies are usually found in the heel and forefoot of the shoe and add an extra degree of cushioning without much extra weight. Stiff materials are used in some basketball shoes on the medial or inner side of the shoe to reduce inward rolling of the foot. Heavier densities of cushioning materials may also be used in the medial area to increase a shoe's stability. The mid-sole can negatively affect stability if the cushioning materials are too thick.

Figure 16: "High tech" tennis shoe incorporating an advanced cushion mid-sole, a mid- and forefoot stability system, and a high abrasion court gripping outsole.

Outsole

The outsole of a good basketball shoe should be flat and moderately wide to create a stable base and help prevent ankle rollover. The herringbone pattern is most common and provides enough traction to keep the player steady during quick stops and starts. Most shoes are designed for indoor play. If play is most often on outdoor courts, a shoe with a more durable outsole should be used. Some basketball shoes are designed specifically for outdoor play and feature heavier rubber outsoles

Gender-Specific

Most women should not buy men's basketball shoes. Men's shoes are built on a wider last than women's shoes and are generally too wide for a woman's foot, and do not offer an appropriate degree of stability.

Tennis Shoes

Tennis shoes are very important to the player, owing to the quick start and stopping, cutting, pivoting, and jumping that is part of the game. Tennis is a sport that is rough on shoes, particularly the sole and toe area, so finding a shoe that is durable enough is important. The shoes should have a fairly wide heel and good heel counter for rearfoot control. The traction surface of the heel should be

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shock absorbent and of a non-slip material.

The heel cup should fit snugly, which helps prevent the foot from slipping forward in the shoe. The shoe should have a medial arch support that is appropriate for the individual's arch. There needs to be good lateral support for the forefoot. The toe-box of the shoe must not create pressure and should conform to the general shape of the foot. The vamp (upper front) of the shoe must never constrict or cause pressure across the metatarsal area or instep (Figure 16).

Other Considerations

Court surface, style of play, and foot structure should be considered when selecting a tennis shoe. A competitor, who plays mostly from the baseline, requires a shoe with a lot of lateral support to handle the sideways motion. The shoe needs more sidewall support to stabilize the foot during the quick lateral, side-to-side movements that are encountered.

The baseline player also needs good support for forward and rear forces as well as a shoe with a highly durable sole.

The serve and volley player generates tremendous levels of forward forces in the forefoot or toe-box area of the shoe. These players tend to frequently charge the net and slide the back foot along the court during the serve, so a shoe with a durable toe-cap (also called a reinforced toe) is essential. Appropriate shoe-wear for these players includes a large toe-box to provide adequate room so the toe will not slam against the end of the shoe. Without the appropriate shoe, these players are susceptible to developing tennis toe (subungual hematoma).

When playing on a hard court, shoes with more durable soles are essential. Clay and grass courts have softer surfaces which are more forgiving on shoes, so durability requirements aren't as great.

Court surface, style of play, and foot structure should be considered when selecting a tennis shoe. A competitor, who plays mostly from the baseline, requires a shoe with a lot of lateral support to handle the sideways motion.

Minimalist Running Shoes

Looking back to the first Olympics, when barefoot-running champions competed, many current runners have wondered whether ditching their running shoes might improve times and reduce injuries. Ethiopian barefoot runner Abebe Bikila won gold in the men's marathon in the 1960 Olympics, and South African Zola Budd ran barefoot in the 1984 Olympic games. Though these Olympics brought barefoot runners to the world's attention 50 years ago, the popularity of the minimalist running shoe was intensified in the spring of 2009 with the publication of *Born to Run* by Christopher McDougall. The book, which became a *New York Times* best seller, discusses the Tarahumara Indians of northern Mexico who reportedly suffer fewer running injuries than North Americans do, even though many members frequently race ultralong distances in thin rubber sandals. *Born to Run* also presents reasons why barefoot advocates believe that the best way to learn good running form is to be completely unshod, letting your legs and feet feel the subtle changes in impact so the body can be adjusted to lessen that impact. Today, the minimalist footwear market, counting only the foot glove-type shoes with no support, makes up four per cent of the overall US running shoe business.

The key difference between running in or out of a traditional running shoe is how the foot strikes the ground. Barefoot or minimalist shoe runners land more on the middle or front of their feet. Runners in traditional shoes strike on their heels. When the heel hits first, an immediate force is sent up the lower leg. When landing on the midfoot, the runner controls the landing more with their muscles and less force comes up the leg. Irene Davis from the University of Delaware proposes that without a well-cushioned shoe inducing a runner to extend their stride, they will take shorter, more frequent steps and land much more softly. They will be less likely to develop tibial stress fractures, plantar fasciitis, and other injuries common to runners. Daniel Lieberman of Harvard University found that native runners in Kenya who grew up running barefoot most often had a forefoot strike. Their magnitude of impact was a third of that of rearfoot strikers in shoes. Many researchers, though, believe that runners need cushioning, both in the forefoot and especially in the heel, to absorb the shock from the road. But because the cushioning in traditional running shoes lifts the heel off the ground, additional hardware such as medial posts and plastic shanks were added to the midsole to provide stability and counter the effects of overpronation. Fueled by the minimalist shoe phenomenon, many shoe makers have begun to engineer minimalist models with new low-to-the-ground

Figure 17: Barefoot-type running shoe designed for natural running and offering a near-barefoot Experience.

Continued on page 100

Athletic Shoe *(from page 99)*

designs and ultralight materials that still provide cushioning while increasing flexibility. Some of these new shoes have heel heights of just eight millimeters, compared to 38 millimeters on some of the popular motion-control shoes.

There are two basic types of minimalist shoes to choose from; the "barefoot" shoe and the minimalist running shoe. "Barefoot" shoes offer the closest feel to running truly barefoot. Their soles provide the bare minimum in protection from potential hazards on the ground. Many have no cushion in the heel pad and

Figure 18: Minimalist trail running-type shoe with a zero drop midsole encouraging midfoot or forefoot strike but with ample protection and grip.

a very thin layer (as little as 3-4 mm) of shoe between the foot and the ground. All are characterized by a "zero drop" from heel to toe (Figure 17). This encourages a more natural midfoot or forefoot strike. Traditional running shoes, by contrast, feature a 10-12mm drop from the heel to the toe. Runners with high arches tend to have the shortest break-in time and fewest problems with these types of shoes. Runners who are pronators may struggle to adjust to the lack of arch support. When fitting theses shoes, the heel and toes should be comfortably snug and "fit like a glove."

Minimalist running shoes are a cross between barefoot shoes and traditional running shoes and offer an excellent way for many runners to ease into barefoot type running. These shoes are extremely lightweight in construction with little to no arch support and a minimal heel height of 4-8mm to encourage a natural running motion and a midfoot strike. They offer some cushioning and flex. The toebox is generally roomy to allow toes to splay inside the shoes, enhancing grip and balance (Figure 18). Several styles offer some stability posting to help the overpronating runner transition to barefoot-running motion.

Another major consideration when choosing a minimalist shoe is the type of surface that one will be running on. Trail specific shoes feature soles with aggressive tread for more traction. Some models offer rock plates in the soles, increased torsional rigidity and leather uppers to protect feet from abrasions. Road-specific shoes tend to have razor-siped rubber soles for enhanced slip resistance on slick surfaces. They offer little protection from sharp or uneven terrain. Most minimalist shoes can be worn with or without socks. The benefits of wearing socks include extra warmth, odor deterrence, and blister protection. For "five finger" type shoes, special socks are required.

Just as radically increasing mileage or speed can lead to injury, so can making a major change in shoes. A runner should ease into the use of minimalist shoes. If someone is used to a stability shoe, they should start with a slightly more cushioned and supportive performance trainer before moving to a racing flat or barefoot shoe. Most runners should stick with their regular trainers for long runs and use their minimal shoes for shorter distances until they are used to training on them. They can also build up foot strength by doing barefoot strides on grass and by walking in minimal shoes. A gradual transition should help keep the runner from getting injured. **PM**

Minimalist running shoes are a cross between barefoot shoes and traditional running shoes and offer an excellent way for many runners to ease into barefoot type running.

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Dr. Caselli is Adjunct Professor in the Department of Orthopedic Sciences at NYCPM, Adjunct Professor at Ramapo College of New Jersey, and a Fellow of the American College of Sports Medicine.

CME **EXAMINATION**

SEE ANSWER SHEET ON PAGE 103.

1) Sports-specific athletic shoes should be recommended:

A) Only for competitive athletes
B) Only when engaged in a sport more than three days a week
C) Only when used in competitive play
D) For anyone participating in a sport more than three hours per week

2) Which one of the following is not correct concerning proper athletic shoe fitting?

A) Feet should be measured each time shoes are purchased
B) Athletic shoe size should be the same as a comfortably fitting dress shoe
C) Shoes should be fitted at the end of the day or after exercise
D) Shoes should be fitted to the larger foot

3) A running shoe should be replaced at least every:

A) 100 miles
B) 250 miles
C) 500 miles
D) 750 miles

4) Studies have shown that the best material for an athletic sock is:

A) Cotton
B) Nylon
C) Acrylic
D) Polyester

5) The best running shoe last for an overpronated heavy athlete is:

A) Straight board lasted
B) Curved slip lasted
C) Straight slip lasted
D) Curved combination lasted

6) Which of the following is not a characteristic of the treaded outer sole of a running shoe?

A) Designed to resist wear
B) Primary shock absorber of shoe
C) Provides traction
D) The harder the material, the heavier

Continued on page 102

(Continure from page 101)

7) The best running shoe to recommend for an athlete with high, rigid arches is:

A) A shoe offering maximum motion control
B) A straight-lasted shoe
C) A stability categorized shoe
D) A curved combination-lasted shoe

8) The proper fitting of a soccer shoe includes:

A) 1/2 – 3/4 inch of space between the end of the longest toe and largest foot
B) Slight heel movement
C) Snug, glove-like fit
D) Fit one size larger than dress shoe

9) Which one of the following does not affect the shock absorbing quality of a running shoe?

A) Running on a cold day
B) Running over 10 miles a day
C) Running in a shoe with a gel insert
D) Both A and C

10) Soccer cleats should have longer studs when playing in which one of the following conditions?

A) Soft field in the rain
B) Hard cold ground
C) Synthetic turf
D) Long studs should not be used for any of the above conditions

SEE ANSWER SHEET ON PAGE 103.

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EXAM #1/24
Selecting the Proper Athletic Shoe
(Caselli)

Circle:

1.	A	B	C	D	6.	A	B	C	D
2.	A	B	C	D	7.	A	B	C	D
3.	A	B	C	D	8.	A	B	C	D
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5.	A	B	C	D	10.	A	B	C	D

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