ECRONICON OPEN ACCESS

ORTHOPAEDICS
Research Article

Walking and Running Shoe

O Ruello*

Pédicure Podologue D.E, D.U Podologie du Sport Université de Toulouse, France

***Corresponding Author:** O Ruello, Pédicure Podologue D.E, D.U Podologie du Sport Université de Toulouse, France.

Received: December 13, 2015; **Published:** January 13, 2016

Abstract

Athletic shoes are particularly stressed and suffer according to the disciplines of one to five times your body burden. Specific and adapted to the sport practiced, it is unidirectional (running, cycling, etc.) or multidirectional (handball, football, etc.), their anatomy developed in order that the "plantar system" can produce optimal performance. Today, the world's leading sports equipment uses the fame of amazing athletes in order to sell their products, guaranteeing consumers the performance they seek. They are waging a war without thank you in this lucrative market segment. They develop and produce sports shoes in collaboration with specialists of sport and the race, and with high levels of athletes, in order to meet the needs of each rider. This knowledge of athletes is enabling them to design and make shoes, which are the primary qualities of lightness, protection, comfort, performance improvement. During this presentation we will discuss in the first instance, the anatomy of the running shoe that has evolved through research and technological advances. Secondly, we will have functional and anatomical approaches with its primary user: the foot. Finally, we will address the various actions in the service of podiatry foot from the sport.

Keywords: *Sports footwear; Anatomy of the foot; Subtalar; Footpad; Role of sports podiatry*

Plan

Running history

For a man, the innate mode of travel is a natural means of locomotion. It has long talked about running but in 1940 appears the Anglo-Saxon term jogging. Etymologically, it comes from the English verb to jog which means "go slowly", "trot". This sport which develops in the 1970s in Europe, involves running walk on varied terrain (woods, countryside roads, city streets) and simply to maintain fitness. This coincides with the awareness of urban modernization and lifestyles of industrialized societies greatly reduce if not eliminate, any physical activity. To compensate for our excessive sedentary lifestyle, sport has become a necessity. More than just a fad, jogging is a sport very practiced because of its simplicity, ease of implementation, its beneficial effects on the cardiovascular and musculoskeletal system.

Since, jogging has continued to evolve and diversify. Today, one can identify three main variants are:

1. Jogging, is a training method by running as support other sports activities. For example, a football player made the day after a match jogging slagging 70% of its maximum volume oxygen (VO2 max)
2. Cross country or trail is a fast pace to race work- woods and fields, where competition appearance dominates which calls for a specific shoe;
3. The running: the runners are the most bitten joggers, their "playground" is the tarmac. They join distance runners to participate in semimarathons, marathons, 50 or 100 km races.
4. In France, the phenomenon moved to the end of 1978. In December of the same year Blavier Milou (tif sporting journalist) speaks jogging in these terms: "It's a fashion that comes from the States STATES and which is currently the rage in Britain, winning France, and consists of jogging on the boulevards, avenues, streets."Jogging" originates from the need to break free of a mechanized society to the extreme.

Some important dates in the sports world

Parallel to the development of sports performance worldwide, the sneaker has seen many technological modifications:

a. In 1920, Adi Dassler makes his first sports shoe;
b. In 1936, Jesse Owens wins four gold medals at the games Berlin Olympics with Dassler shoes;
c. In 1948, Adi Dassler founded Adidas;
d. In 1965, the Stan Smith shoe factories fate, it was the most sold in the world;
e. In 1966, creation of the firm Nike.
f. In the 1970s, firms create consulting firms in order to develop their concepts and meet the growing market:
g. In 1970, Nike innovates by creating the shock absorbing sole (air cushion);
h. In 1973, Adidas creates the rigid stiffener;
i. In 1989, launch of Adidas Torsion;
j. In 1990, the launch of Nike Air Max;
k. In 1996, launch of the Feet You Wear program;
l. In 2010, launch of Vibram Five Fingers shoes.

Anatomy of the running Shoe

For the the body not to suffer, it has developed the most technical sports shoes: running shoe (running shoes). She was born at the beginning of last century, it is first a simple leather shoe designed for racing athletes walk and do not protect the ground vibrations. In the 1970s, the sport to the streets, jogging becomes the sport of urban and foot attacks the concrete. Result, a simple leather soles or rubber suffit do more to protect him. The one-piece shoe 1970s gives way to a high-tech shoe consists of several components. Currently, the anatomy of this running three parts (Figure: 1) the upper, the shoe bottom and the insole.

Stem

The rod is made up of several parts: the upper (front part of the boot covering the instep and toe) having a role of maintaining and flexibility;

1. Reinforcements (front, rear and side) whose main role is stability
2. Protection of the Achilles tendon, for example with the presence of a cutout of the back of the shoe (Achilles notch) provided to prevent the heel to warm up in the movements from the bottom upwards
3. The tongue

Figure 1: *Technical characteristics of the running shoe.*

1. The inside of the shoe;
2. Yaw.

It is important to note that the forms are different depending on the brand and are often decisive in choosing a pair of shoes.

Shoe base

It fulfills several roles:

1. Cushioning;
2. Stability;
3. Adhesion;
4. The abrasion resistance.

It consists of two parts:

A. The outsole or external aims to provide good adhesion to the shoe and protect the midsole. The material used is the reinforced rubber for durability and grip especially on synthetic surfaces;

B. Midsole, very important part of the shoe, allow for more or less cushioning and must feel some home comfortto the user. It is in general vinyl acetate copolymer (ethylene - vynil acetate [EVA]), for its light weight and provides good protection against shock but has average durability.

Sock

It has different goals:

1. Stability in shape (footbed);
2. The comforts of home;
3. cushioning (protection);
4. Absorption of sweating (hygiene).

It is composed of polyurethane in most cases. Podiatry, it can be replaced by a foot orthosis moformée thermal specific to the sport morphotype. The major global designers have relatively identical studies approaches; even though their technology may differ on some points, their main aim is to fight against the vibration and the shock wave.

Absorption of impact energy

It shall be provided by one or more gifted material properties of both elastic and cushioning, progressively deforming in shock, likely to partially dissipate energy as heat (amortization) and/or refunds kill by resuming their original shape (elasticity). The nature, thickness, density materials, influence of quantifiable way on the energy absorption capacity of the sole.

Absorption of vibration phenomena generated during the impact

It is less known, these phenomena are the cause of certain pathological manifestations such as fatigue fractures (resonance phenomenon).

Current solutions

They focus on improving the amortization (by acting primarily on the midsole) and stability.

Amortization

It is basically directed by the midsole of the sole part which elevates the heel and tapers gradually to disappear under the forefoot; where the number and variety of innovations more or less effective on this element. The thickness of this sole under the heel was gradually assimilated in elevation between the heel and the forefoot. It may vary on average from 20 to 40 mm in some running shoes.

The way to improve the damping properties of a seme-lage is also by simply increasing the thickness of it a few millimeters. The insole "basic" is EVA, thermoplastic polymer microporous provided good lightweight properties and shock dissipating. The composite inserts, newer, involving materials of different natures: an outer shell, usually polyurethane, dense, contributing to stability and surrounding a softer heart, recessed into the hullance rant depreciation. This is generally EVA, but many variations exist (airbag Nike mini-mattress pneumatic injection freon, stronger than EVA, shock absorbing identically, but a little heavier and desta- bilisant; tube Hydrel Reebok [Energy Return System] supposed to deform on impact on the ground and then return "30% more energy," etc.).

Stability

It is provided by various elements of the boot:

a. Midsole, with its composite nature and its curved relief molding the calcaneus;
b. The counter, constant, rigid and resistant, more or less extended towards the front, in particular the internal part of the stem.
c. The stabilizing buttress, kind of horseshoe surrounding the bottom thereof, forming an intermediate skirt, and improving the connection between the rod and the sole assembly;
d. The insole can be replaced by an orthosis casting resin produced by the podiatrist after a clinical examination. It improves stability and can also correct some static disorders.

Selection criteria of a shoe

The athletic shoe should be specific for each tive sporting activity and it is studied and designed according to the needs of the athlete. A shoe is not a walk although some sports brands say "copy" to switch from one to another, but making a form is needed. The latter takes into account the morphological characteristics of the foot (width, length, volume, etc.) which makes it possible to find" its shoe foot". The major disadvantage is the production of shoes series, whose shape is a rough caricature of a physiological foot. The choice of the shoe should under no circumstances be made on purely aesthetic criteria.

Indeed, during sport, especially that of running, the foot is subjected to regular and repetitive shocks of up to three to five times the body weight, and the number of ground support equipment can reach 42 000, in the case of a marathon.

Then settled a struggle "foot-shoe"[1]:

Article 1: if there is conflict, the foot always loses. If your old pair of shoes suited you perfectly, then know to stay faithful, shape suits you. If however, you were "not comfortable in your sneakers," the ideal is then to seek advice from specialized brands. The reflex should be the same if you plan to change course and embark on the trail for example.

Article 2: All shots are allowed.

a. The toe (blisters, bruises, etc.) allow at least one size larger and try the shoes in order to preferentially day.
b. The posterior aspect of the heel (eg Haglund's syndrome, etc.): choose a shoe with good strong counter and a flexible Achilles notch that do not come into conflict with the base of the Achilles tendon.
c. The top of the foot and instep of the foot where branched nerve and vascular cations can be compressed by a lake too energetic age. We must find a compromise between comfort and stability to avoid friction phenomena sup- complementary and excessive plantar compression. Multiple upper eyelets put systems allow different settings depending on the width of your instep of the foot.
d. The sole is a zone of conflicts, ultimate compression and shear (pseudochromydrose plantar example). Good health naturally depends on the quality of depreciation (cellulograisseux dimpling, etc.).
e. The inner sole of your shoe (also known as sock) must be comfortable, reduce friction and absorb sweat. It can be removed freely from the shoe, allowing, for example, be replaced by a sole custom thermoformed.

Article 3: Mé fier is treachery of the sock including sewing that can play the role of a foreign body in the shoe. We must prefer cotton socks, looped or seamless. Currently, several technical brands (repre- sented by Thyo example) are present in this market of the said sock "anatomical".

Article 4: The shoes are standardized, but the foot, he is not always. All riders are not the same vein; all feet are off the ground the same way. The so-called universal shoes are best suited to most sports. They respect the best fupport lated and cause minimal stress to the plantar system level. We strongly advise against the use of shoes called "pronation" or "underpronated" which designate the use of medical terms, technical shoes often going against the natural biomechanics of the musculoskeletal system. They often generate tech- bilateral and symmetrical nopathies next to the lower limb. In use, do not expect the injury to change your running. For shoes with a thick sole (over 200 g) you can travel 1500 kilometers on average. For lighter pairs, count up to 500 kilometers.

Anatomical and functional approach of the foot

It is located at the lower end of the leg, alone comprising 26 bones and whose anatomy resembles that of the hand. The peculiarities of this walk is structurally because it must adapt both to maintain static support, but also dynamic in order to ensure the displacements [2,3].

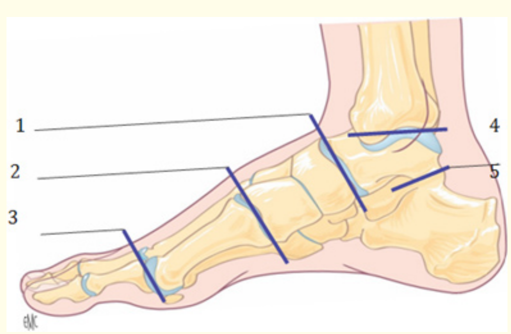

Figure 2: *Pro fi joints of the foot 1. Articulation Chopart; 2. Articulation Lisfranc; 3. Metatarsophalangeal joint; 4. Ankle joint; 5. Subtalar joint or Astra- galocalcanéenne.*

There is therefore a compromise between its mechanical rigid structure composed of the skeletal system and capsule ligamentous on statically and its flexible structure, governed by the musculo- tendinous system that ensures the dynamic. At the base of the joint set of the foot (Figure 2) is the talocrurale joint which transmits all the functional requirements of the musculoskeletal system. This joint forms a clamp or mortise which is embedded in the embankment or tenon talar. It has a transverse adaptive role during the race on rough terrain. The subtalar joint, has a great capacity to adapt to the terrain, and describes the axis of Henke (virtual axis) of three-dimensional movements that are inversion and eversion.

The midtarsal joint (Chopart) is very important too, connecting the posterior to the anterior tarsus tarsus. It fills the adapter role of the forefoot over the rearfoot (Hendrix torsion bar), the main movements are pronation and supination. Finally the tarsometatarsienne joint (Lisfranc) plays an important role in the digitigrade stage, especially that first ray propelling. As we have seen, all the bones fit together dynamically, giving the foot a quality that is flexible, allowing it to adapt to any terrain, as well as a cushion that is a significant part of the kinetic energy. These bones are on the other hand, firmly connected by capsuloligamentaires systems, ensuring structural stability in relation to the constraints that the foot undergoes (body weight, kinetic energy, etc.). In addressing the subtalar again from another angle, one can distinguish in the plantar system functionally the talar calcaneal foot and foot, also explaining the existence of these two dynamic qualities.

The talar foot, generally flexible, consists of:

1. Slope;
2. Navicular;
3. The three cuneiform;
4. M1, M2, and M3.

The calcaneal foot consists of:

a. Tthe calcaneus;
b. The cuboid;
c. M4 and M5.

It consists of less bone and has a greater stability and strength.

This organization of the talar calcaneal foot and walk willingly explains the overload of the third intermediate space tatarsien dynamically by the existence of friction shear phenomena at this level (Morton syndrome).

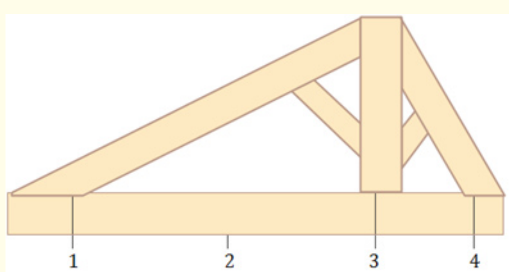

Figure 3: *Conceptual approach of the foot. The foot can be schematically represented by a firm will be called podal farm.*

1. Arbaletrier earlier, consisting of the metatarsal range: 5 metatarsals and 14 phalanges. The two main elements of ground contact of the forefoot are the first and fifth metatarsals. This is connected to the ridge rafter through the Lisfranc interline.
2. Entered consisting of plantar ligament formations.

3. Top, transformed by means of tarsal bones: scaphoid, cuboid, three cuneiform. The anatomical connection is established through the joint Chopart. The central position of this device is in a real joint pivot about which organize the movement of longitudinal rotation of the forefoot.
4. Rafter is represented by posterior calcaneus. Single bond with the ground is element yet to bear half of the body weight.

Foot movements are controlled by intrinsic muscles on one hand and extrinsic on the other. The latter, located in the lodges of the leg, have different actions in the foot. Some role for the plantar flection of the foot, which is the spring cipal sural triceps, which may be in some cases cause a condition called equinus.

Others are responsible for the dorsal flexion of the foot, they are located in the anterior compartment of the leg, in the case of the anterior tibial. The imbalance of one of these parameters leads logically pathologies in the foot, altering the integrity thereof in the static and/or dynamic (Figure 3).

Biomechanics

The foot has been the subject of many studies morphologically. Many concepts have been developed, several authors have contributed their vision as Destot, Lelievre, Dolto, etc. The latter characterized the following way of foot structure lows: the foot is organized in a vault or podale farm which is supported at ground level tuberosity of the calcaneus back and forward at the level of the metatarsal heads, especially the first and fifth head.

Dynamic Pieden

The foot remains very rarely static. On the contrary, belonging to the musculoskeletal system, it is in constant motion when walking or during the race. The race is different from walking by the absence of double support phase. Indeed, it is characterized by a succession of unipodaux alternative supports, with between two successive presses a period in which the body no longer has any contact with the ground. The stride is the image of the rider in action: it is the movement of the legs, but the arms, positioning of the head, shoulders, trunk, pelvis. All this influence the movement of the legs. The aftermath is the result of our morphology and aesthetics of each individual, it depends on the size of the relationship between bone segments, the rider's weight.

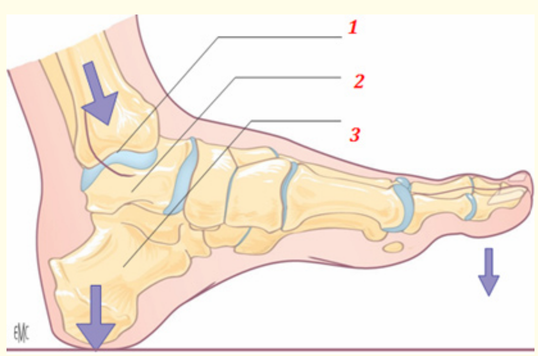

Figure 4: *Phase taligrade. 1. Ankle joint (tibia- fibula / talus); 2. astragalus; 3. calcaneus.*

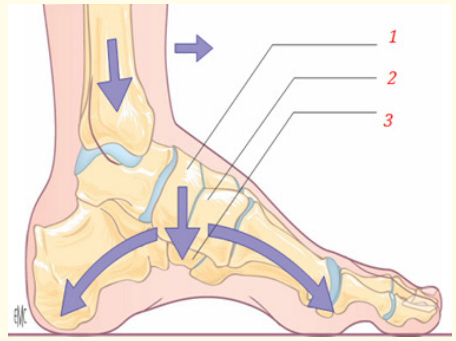

Figure 5: Phase plantigrade. 1. Scaphoid; 2. Cuboid; 3. Cuneiform. But also the flexibility and power of its different muscle groups. Thus, no two riders at the same stride

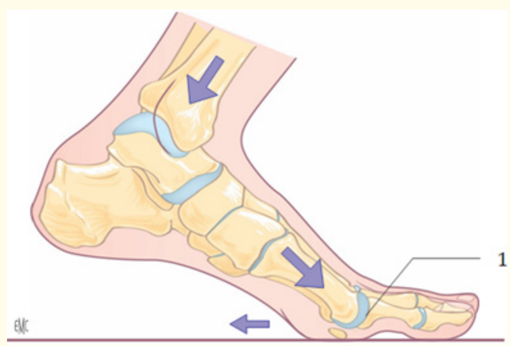

Figure 6: Phase digitigrade. 1. Metatarsophalangeal joint.

Contact foot basement

The conduct of the foot to the ground during the race is divided into three major phases:

a. A phase of attack or depreciation;

b. A stance phase or balance;

c. A thrust or propulsion phase.

Contact of the foot on the ground the time, at a speed of 10 km/h, is between 200 and 250 ms.

Attack phase

The foot is in contact with the ground, the talocrurale is 90°. The impact typically occurs on the outer part of the heel and is approximately 10% of the foot contact the floor. At the anterior and posterior heel, skin is pain by a thick quilting foot cellulograisseux ensuring natural protection favoring the fight against crushing and shearing. This is when the foot is most in need of shock absorption (Figure 4).

Support Phase

It corresponds to the passage of the rear foot to the forefoot and represents 50% of the time of contact of the foot to the ground. It was at that point that is measured pronation. During this period, the foot needs a maximum of stability (Figure 5).

Pushing phase

This is the last phase of the progress of the stride where the foot will give impetus and leave the ground. This phase represents about 40% of the contact time on the ground. At this point, the foot must ensure its directional control. A cushioning excessive shock under the forefoot can affect its stability (Figure 6). To provide a shoe for every runner, it is neces sary, to analyze in detail the progress of the stride. Each foot, each stride is different. A clinical study will be required to advise the choice of a pair of shoes.

Footpad: the ally of the foot

The race is a traumatic sport for the body, each of ours not to submit to our heels, a shock equivalent to a magnitude 4 earthquake on the Richter scale. Each step causes a shock wave that infiltrates from heel to head through the joints, tendons and muscles. The foot must undergo in the race at least three to five times the weight of the body. The foot has a natural ally in the fight against the shock wave, the footpad. [4] This wonderful bush is yet severely tested during sports practice and can even disappear irreversibly. Depreciation concepts and shock absorption are basic in athletes. It is on two specific points that firm's sneakers are developing proprietary systems, which are presented to us each year as so many "revolutions" in terms of shock absorption and/or restitution 'energy.

As we saw earlier, the foot also has its osteoarticular structures, musculotendinous, and ligamentous capsulo subcutaneous means to adapt to the terrain but also to create a damping system not giving the elasticity and flexibility. During the race, the runner is propelled by a series of "hops".

The foot reacts like a ball; when it touches the ground, it deforms, it loses kinetic energy but accumulates the elastic strain energy. Then the elastic relaxation restores the ball to its original shape and propels upward. This principle of crushing-expansion shows that the foot has spring ability through the arch and its ligaments. The elastic structures that are the foot arch and Achilles tendon represent the springs of the lower limb. In the foot, amortization is ensured through joint movements (subtalar joint, biomechanics of the first ray, etc.).

The human foot needs an elastic material to mitigate the impact with the ground, the damper being suffi musculoskeletal health. A natural absorber extremely effective is represented by the plantar subcutaneous tissue.

Structure

The footpad is thinner at the plantar arch and increases at the points of support, up to 2 cm thick at the heel. This fabric is made of many fat lobules, consisting of a multitude of adipocytes. These lobules are contained in connective tissue boxes reminiscent of a honeycomb. Each cell represents a diamond; this characteristic has been the subject of studies and design damping systems in different firms.

This fabric has a role of mechanical protection of its semi-liquid fat texture that allows you to evenly distribute pressure, thus reducing the loads to be carried per unit area.

Roles of podiatry

Podiatric sports -related problems are many. The importance of the plantar support on the entire skeleton is very moderate static, but they become particularly important when repetitive movements. [5] One can consider a variety of symptoms. The tif sporting gesture must be detailed and analyzed: when the supports are made and in what condition? The soles developed for training will be different for com- petition Trainers (for weight gain mainly)

Concretely usable observations

First, from a clinical examination in the cabinet that will always static and dynamic podiatrist analyze posture (Fig. 7), the morphotype , history and the history of the complaint , etc.

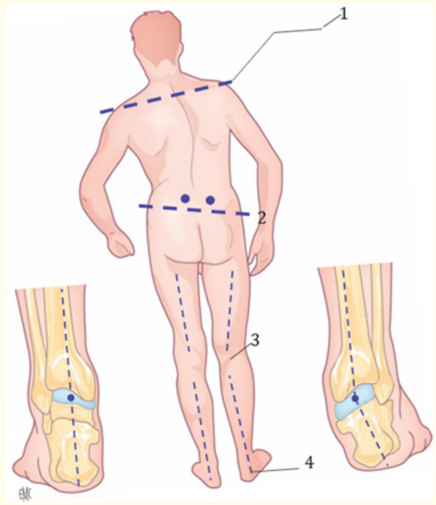

Figure 7: *Impacts on foot posture. 1. Static analysis; 2. Pelvic tilt; 3. Valgus knee; 4. Influence on the posture of the foot.*

Figure 8: *Dynamic Study cabinet.*

In practice, the video is used to study the physiology of the athlete, during a clinical examination. This visualization will occur in dynamic electronic treadmill with video and computer control at a speed close to that of the sport concerned for a good observation of the movement (Figure 8). It is thus possible to establish a podiatric diagnosis and guide treatment while respecting the biomechanics of each sport. A comprehensive investigation material enables a thorough diag- prognostic and understanding the sporting interest and the role of foot orthotics.

(Figure 9) The investigative materials include:

a. Static and dynamic podometries used to recher- this is expensive and it studies the projection of the center of gravity in the triangle of sustenance, learning about the transverse and lateral positions of the Athlete;
b. Digitization of video images to make a comparison with the different images recorded. This technique involves the capture of video images and the interpretation thereof by means of drawing software to draw axes and quantify the observations.

Analysis by the sports podiatrist outside the cabinet

He went on the field in order to know the sign of the studied sports and to make proper correction (Figure 10). It can film gestures during cross sportsman, competitions, indoor meetings, etc. It analyzes them afterwards. More and more frequently, it fits logically in sports medical staffs and brings its expertise at the service of sport.

Contribution of chiropodist in the choice of footwear

In collaboration with manufacturers that provide information on new technologies and new collections, it is able to advise a model compared to another according to the morphology of the rider. [5] In road racing, it is important to differentiate between the sports competitions and sports recreation.

Figure 9: Example Technical platform *(A,B).*

Figure 10: *Sports in rough terrain (trail).*

Other means available to the chiropodist

The orthosis blister is carried out starting from a blank whose top has been formed by molding under the patient's foot in direct contact with the foot sole. Foot orthotics is part of the treatment and cannot solve all problems.

Conclusion

If modern shoe Running presents weaknesses, wears, deforms, do not ignore the extraordinary progress made in this area. [6] These advances are, inter alia, the use of new materials which are the subject of ongoing research. They have improved the performance and also prevent many accidents or incidents of skin, muscle and tendon. The ideal shoe cannot exist because it is always a compromise in the choice of more or less cushioning or elastic materials, in the form and in the price.

Despite all the interest that can be worn to the Chaussee sour in the running, one should not forget the rules of progressive training, warm-up, in sufficient recovery and dietary rules that are too often neglected. All these parameters are often responsible alone for pathologies that could be compromising for the sporting future of a runner. Finally, the shoe is presented by manufacturers as a sophisticated product, more and more technical, which is actually meant increasingly gimmicky and more and more expensive. Now this product is frequently sold without reliable information about its real qualities and durability, especially with no guarantee for the user. So it often happens that the shoe is unsuitable, then entraî- ing some discomfort in the user.

The podiatrist will play a leading role in the confection of foot orthotics in shoes suitable measures. The sneaker is so personalized in order to improve performance through better muscle and joint work.

Acknowledgments

Eric Benguerbi (podiatrist state certified the Institute d'Assas, graduated from university certificate podiatry applied to sport [AUPAS], responsible for the teaching of AUPAS, president of the Association national sports podiatrists [ANPS], approved by the French athletics Federation [FFA]), for the confidence, guidance and listening carefully. He was able to book me in our various interviews, as well as for his assistance in the design and implementation of this article. A sporting and friendly thanks to David Pasquio for his image rights. I also want to mention the technical participation of Nike, Adidas and Asics France, which enabled me to complete this article.

Bibliography

1. Saillant G. "L'agenda du running". Paris: Édition LC et scientifique ADIDAS (1998).
2. Poux D. "Technopathie du jogging". Paris: Laboratoire Novartis (1998).
3. Abeillon G., *et al*. "Traumatologie et rééducation en médecine du sport". Paris: Arnette (1992).
4. Samuel J. "Pathologie et soins du pied". Paris: Maloine (1996).
5. Boissinot P. "Semelles orthopédiques et sport". Paris: Laboratoire Ciba Geigy (1994).
6. Hérisson C., *et al*. "Pied et sport de loisir". Montpellier: Sauramps Médical (1997).
7. rue Éric-Tabarly, 56700 Hennebont, France. conographies supplémentaires

Volume 2 Issue 6 January 2016