

*When Manchester United soccer hero Wayne Rooney recently suffered a broken metatarsal bone, it brought into focus the recurring question of protection in sports footwear. The same thing had happened to David Beckham previously. Could their injuries have been avoided and is there any soccer shoe feature that would prevent similar injuries to other top players in the future?*

# Is there enough protection in soccer shoes?

Mel Cheskin

**W**hile on occasion an athlete may suffer foot and ankle pain from an isolated traumatic injury such as a fall or collision, the vast majority of foot problems can be classified as overuse injuries. They can result from improper training (too much, too soon or too fast), poor flexibility, weakness or biomechanical abnormalities. Whether injury is caused by trauma or overuse one of the greatest risk factors involves the type of protection afforded by the footwear. Choosing the right shoe for your sport can be the difference between spending time on the sidelines or in the competition.

Soccer is the most popular team sport world-wide with an estimated 50 million amateur participants—to say nothing of the expensive talent at professional level. Unlike foot and ankle injuries in tennis and running, which are usually through overuse, those in soccer often result from trauma such as a direct blow to the lower leg. Because soccer is a contact sport, collision injuries from striking another player are common and account for approximately 30% of the total.

## The parameters

After extensive testing, France's Centre Technique Cuir Chaussure Maroquinerie (CTC) analysed the demands placed on soccer shoes and established there is no such thing as an all-purpose shoe. Among the factors it has to cope with are:

- Distance—players can run over 10km per match at professional level
- The length of training sessions and matches
- Alternating phases of running, acceleration, dribbling, sliding, tackling, etc.

While this appears demanding, a look at the figures

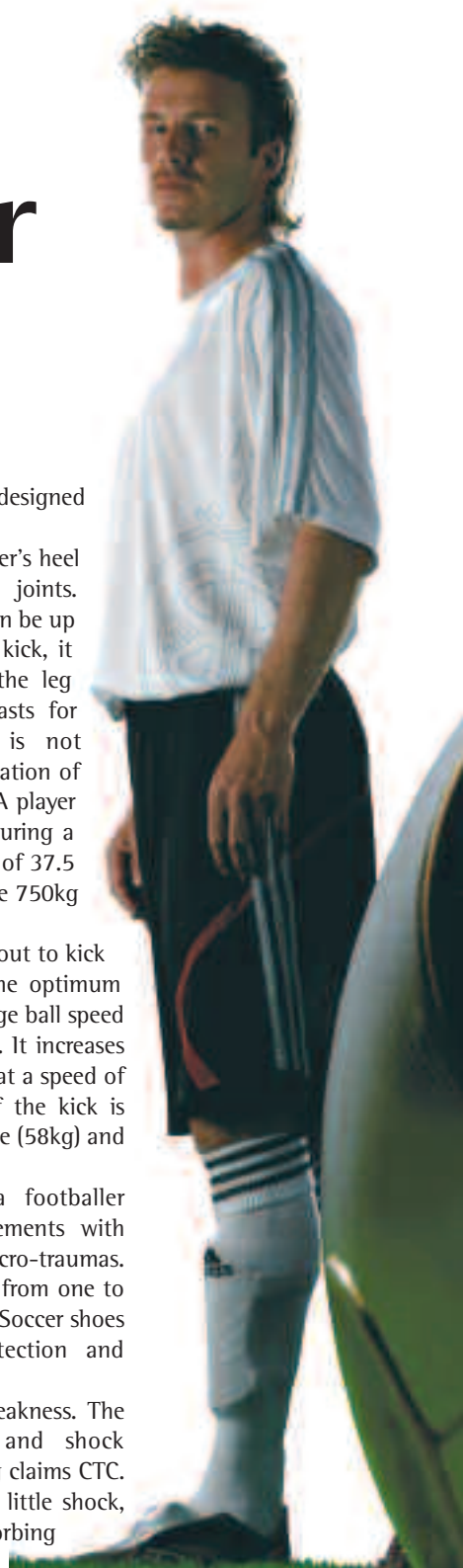
clearly shows the importance of well-designed shoes.

With every stride, the impact on a player's heel travels up the leg and through the joints. Depending on the playing surface, this can be up to twice the weight of the body. For a kick, it can be as high as 10 times that on the leg remaining on the ground. This peak lasts for approximately 20 milliseconds and is not perceptible in real time, but the accumulation of these micro-traumas can lead to injury. A player weighing 75kg covering 10 kilometres during a match will have sustained the equivalent of 37.5 tons of pressure under each foot, plus the 750kg sustained every time he kicks the ball.

The angle of the leg as the player is about to kick is also important and 30-45° defines the optimum speed between player and ball. The average ball speed when a player is static is 80km per hour. It increases to 110km per hour when the player runs at a speed of between 5-8km per hour. The force of the kick is absorbed by the hip (up to 96kg), the knee (58kg) and the ankle (33kg).

The movements demanded from a footballer (abrupt starts and stops, forced movements with flexed feet and back, etc.) all cause micro-traumas. For 1,000 hours of play, they can suffer from one to 34 injuries, with 70% to the lower limbs. Soccer shoes must therefore provide comfort, protection and durability.

Shock absorption is another major weakness. The sole must combine grip, stability and shock absorption, but the latter is often lacking claims CTC. The sole and studs actually absorb very little shock, and even the heel, which has shock-absorbing inserts in the sock, has nothing like the



Xray image of the bones of the foot



shock absorbing properties offered in a running shoe, despite the fact that a footballer spends 90% of his time running. These facts go some way to highlight the importance of choosing a boot that suits both the surface and the conditions of play, especially for youngsters who are still growing.

### Areas of protection

The protective aspects of soccer shoes should include:

- A tongue that protects the instep from the laces
- A heel counter that provides stability and fit while protecting the Achilles tendon
- Quarters which are padded to protect the base of the ankle (stitching and a padded lining at the toe does not afford enough protection)
- Studs to provide support, security and grip (whatever the number of studs, composition, shape, height and positioning are all crucial)

### Boots have become slippers

Unfortunately, as soccer boots have evolved, they have become lighter, softer, less-protective and lower-cut at the quarter to become slippers rather than boots. Gone are the vegetable-tanned, high-cuts with stiffened toe boxes, forepart support strap and metal eyelets. Tactics and movements in soccer have changed and so the footwear used has also evolved. Players are faster so shoes are lighter; ball control is more important so 'feel' for the ball is essential; passing is more

accurate so imparting spin and direction on the ball upon contact with the shoe is critical in today's game.

What has not changed, however, is the amount of contact injuries such as sprains, soft tissue contusions (bruises), muscle and ligament tears, turf toe (hyperextension of the big toe), subungual hematomas (bleeding under the nail) and fractures (either stress or break). Other than a minimal amount of padding and design improvements in stud positioning and length, virtually nothing has been designed into soccer shoes that effectively prevents injuries. In fact, over time their use may cause permanent bone injuries such as Exostosis (boney protrusions) and Haglund's deformity (Pump bump).

### Padding cuts performance

Soccer is the only sport where the shoe is theoretically required to be continuously in direct contact with the ball. Having said this, it has been shown that a player is actually only in contact with the ball for two minutes during a 90-minute game. The remainder is spent running, walking and standing without the ball, hence the importance of producing a lightweight shoe to conserve energy. "For every 100g of weight that is carried on the foot, your oxygen consumption patterns change," states Howard Lieberskind, a long-time podiatrist with the US women's national soccer team.

Lightweight can also be protective as in the case of sports helmets used in cycling. The problem with introducing hard protective materials into a soccer shoe upper is the loss of 'feel' so that touch and control on the ball suffers. Another 'feel' feature of a soccer shoe is that the sole template is fractionally smaller than the insole so that the upper slightly overlaps the harder sole to create a sock-like construction. Likewise, any padding that could help to protect the foot would also interfere with performance.

### Putting a new spin on things

Imparting spin on the ball is now important and soccer shoes have become increasingly glove-like. Kangaroo remains the preferred upper material for quality shoes due to its flexibility and strength-to-weight ratio. But, at the same time, it offers little support or impact protection. Water-repellent and anti-abrasive microfibres are also beginning to gain acceptance. They are extremely thin and, when combined with a thin layer of latex foam, offer a minimal amount of padding compared with the precious little protection offered by nylon backed leather. In both cases, the thinness of the upper material means that foot bruising is a common occurrence if competition shoes are worn for long practice sessions.

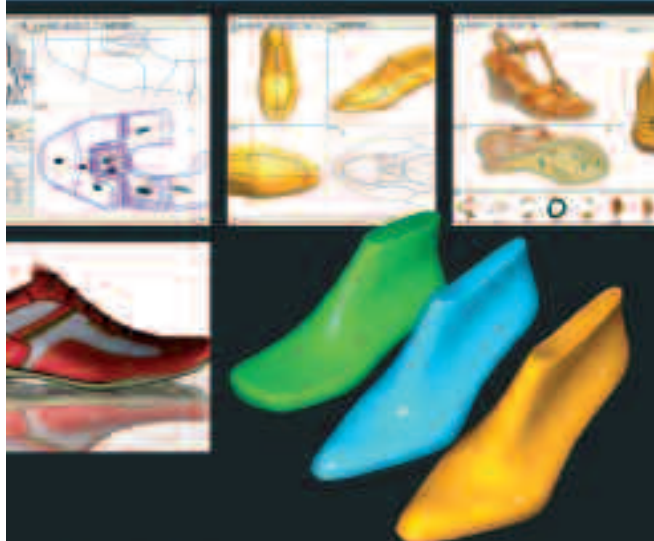
### New solings ease the pressure

Women's soccer has undergone enormous growth over the past few years and, like men, they suffer injuries. Women, it appears, are particularly susceptible to knee injuries such as non-contact anterior cruciate ligament ruptures. Shorter studs on women's soccer shoes have been shown to reduce knee and ankle injuries in young players. It is therefore recommended that studs on women's soccer shoes for younger players should be no longer than one-half inch.

The ability to play on different surfaces was recognised early on and hence the sole of the boot needed to offer resistance or ground traction. The maximum length of ➤



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studs was defined by soccer's governing body FIFA in 1951 and, with the development of new polymers, natural materials have been completely replaced by synthetics.

Traditional conical studs have been cited as the main cause of 'turf-lock' and rotational injuries to both ankles and knees. Today, plugs, studs and cleats of many varieties are used for different playing surfaces ranging from soft wet natural grass to hard dry synthetic turf in an ongoing attempt to reduce the incidence of traction injuries. Tread patterns have also changed to incorporate curved cleats designed in a circular configuration of compressible teeth, developed to produce an anti-torque effect between the sole and the playing surface.

### Biomechanics do help

No shoe can ever guarantee full protection against injuries because a conflict exists between the function of the shoe and the interests of the human body. In soccer, this statement is close to a truism. However, as minimally ineffective as they may be, manufacturers do try to include some of the following injury protection features into their boots:

- Specifically developed women's lasts for better fit
- Padded Achilles tendon guards
- Neoprene sleeves for extra dorsal support and protection
- Padded quarter toplines for ankle protection
- Shawl or kiltie flap tongues to reduce lace pressure
- Poron insock material to reduce plantar surface cleat pressure
- Rigid heel counters for support and kick protection
- Torsionally rigid outsoles for shank strength and improved stud placement to provide better traction and reduce torque on knees and ankles

In terms of fit, one obvious improvement that manufacturers could offer would be width fittings. Despite the preference for players to wear their shoes skin tight, taping or bracing the foot has been shown to help in reducing injuries by offering more protection and stability to the foot. Any additional padding adds bulk to the upper, so models offering additional widths would allow a player to choose a fitting most suited to the added under-shoe protection feature.

Another improved stability feature to improve structural alignment and prevent ankle sprains would be to add better torsional rigidity to the shank of the shoe. This would necessitate an extra depth allowance in the last for a replaceable OTC (over-the counter) or custom-made orthotic insert inside the shoe. The factory insert would be made extra thick to add cushion if selected or removed to accommodate a more rigid, more supportive OTC or custom-made device.

Study and research has resulted in advances in both soccer stud and sole materials and design. Opportunities still remain in the upper of the shoe, where injuries to the toes and dorsal area of the foot still need to be addressed. Shin pads have been effective in protecting the tibia and fibula bones at the front of the leg, so why not add a shock absorbing viscoelastic polymer covering for the exposed metatarsal and phalange bones of the foot? With the extra control features now added to upper materials, it is perhaps time we added some more protection to the upper to keep the high-priced talent on the field longer. 