戶外鞋的科學剖析

A brief scientific review of outdoor shoes

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時至今日，運動鞋因應不同戶外活動需要，發展出很多特定的設計。早在六十年代，不少專家做過很多有系統的研究，但都只集中於跑鞋的力學方面。到了七、八十年代，學者將跑鞋化身為吸震的重要工具。Nike發明的Air吸震系統曾一度成為經典。踏入九十年代，專家才發現吸震不是最重要的環節。事實上，從來沒有任何一項研究比較各大牌子運動鞋的吸震系統。反而，通過很多運動生物力學和病理學的相關研究，近年才有較科學化的鞋款設計，用以提升表現和減少受傷的機會。例如，有研究分析足球鞋釘的分佈影響足踝扭傷的機會；有研究分析足球鞋面的紋理如何增加射弧形球的旋轉力；亦有研究証明重心低、有良好橫向減速坑紋的場內鞋，有助減少快速橫移動作中腳部受傷的機會等等。

不過，熱愛戶外運動人士常穿著的攀石鞋、行山鞋、水上活動鞋等等，相關而結論一致的研究報告少之又少。加上很多時候，因商業秘密或研究的規模等問題，我們很難獲取資料並作分析和比較。例如攀石鞋和水上活動鞋最基本的要求是抓地能力強，但從來沒有鞋商發表其出廠的鞋與物件的摩擦系數，以及温度和濕度對鞋黏著力的影響等。看來我們唯有單憑鞋的價錢去估計它的抓地能力。

Today, specially designed sport shoes are developed for different outdoor activities. In the Sixties, though there were many systematic researches by specialists, they all concentrated on the mechanics of running shoes. Until the seventies and the eighties, scholars turned running shoes into an important "cushioning" tool. The air cushion invented by Nike was once a classic. Entering the nineties, expects no longer considered cushioning the most important element. In fact, there was never a research in comparing the cushioning of different brand of sport shoes. To the contrary, researches that are based on sports biomechanics and pathology have stimulated recent shoe designs which are more scientific and less possible to get injured. For example, research on the distribution of football

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上圖：不同的腳型在不同類型的比賽需用不同類型的鞋。Top: different foot type requires different type of shoes for different kinds of competition.

不過，曾有研究指出，當人類預計踏上不穩或濕滑的表面時，腳掌接觸地面的位置會由後跟前移至腳掌中心，身體重心甚至會前移和增加膝部屈曲角度。這時候不應穿著一些太厚、吸震太多、或後跟位置升高了的鞋款。最新的研究也指出，太厚的軟墊會影響足部對地面的感應能力，更易絆倒。一般指引為二至三厘米已足夠，攀石鞋和水上活動鞋更可以薄多一點。還有，熟練的運動員在滑石上跳動時，多以前腳掌先接觸地面。所以一般場內鞋鞋頭那母趾位置的螺旋紋設計，更會應用在這些鞋種上，以增加靈敏度。

沒有鞋商發表其出廠的鞋與物件的摩擦系數，以及温度和濕度對鞋黏著力的影響。

至於行山鞋，現今科學理論大都同意高筒設計已不重要，因為有部分測試發現，這些設計未能有效減少足踝扭傷的機會。至於前掌不能屈曲的設計，除非是攀登雪山，否則弊多於利。普通人走路，母趾應有60度足背屈的活動幅度。如果穿著前掌不能屈曲的鞋，雙腳唯有增加內旋幅度和減少腳後蹬的步幅距離，來保持直線行走，這樣只會增加母趾痛、膝痛，以致跑起來更費力。

上述談及的設計只是很初步的分析，如果有興趣深入了解，可嘗試尋找這方面的專家如Clarke TE, Subotnick SI, NiggBM, Stacoff A的著作和研究看看。

另外，跑鞋不同的設計對不同傷患所帶來的影響，亦是很複雜的課題，望日後再詳細解釋。還有，穿著配合腳型的鞋墊比穿著適合自己的鞋更重要。如有疑問，應當找運動專科的物理治療師或義肢矯型師給予建議。

shoes spikes can affect the chance of an ankle sprain; research on the threads on the surface of football shoes can increase the rotation and the arc of a shot; and research which proves that court shoes with a low centre of gravity and well-designed horizontal grains can reduce feet injuries in quick transverse movements.

However, for climbing, hiking and water sports shoes we often wear, there are limited researches or reports that reach a unanimously conclusion. In many cases, the results can not be obtained due to the reason of business secrets or the sample size. For example, the basic requirement of climbing shoes and water sports shoes is the grip, but shoe manufacturers never published the friction coefficient that relates to their shoes and products, or the effect of temperature and humidity on the friction of the shoes. It seems that we have to estimate the grip performance by the price.

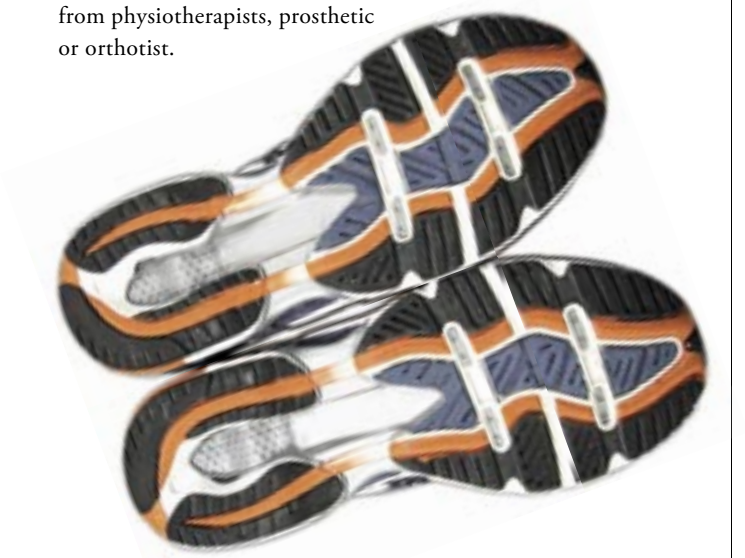
Researches point out that when we predicts an unstable or slippery surface, we tend to contact the ground by our mid-foot first rather than by the heel strike, our centre of gravity would shift forward and increase the knee angle (bend more knees) during foot contact. There is no use to wear shoes with heel raise or too thick cushioning midsole (high centre of gravity). Whereas, the latest researches point

out cushioning materials that are too thick will intervene the feet from feeling the land surface and you are more likely to twist. The usual thickness should be 2 to 3 cm. Climbing shoes and water sports shoes can be much thinner. Many skilful athletes touch the ground with their forefoot when moving on slippery rocks. Therefore, spiral grain designs which are often found on the big toe position of the outsole among court shoes to increase the grip and response of the shoes.

For backpacking shoes, current scientific theories agree that high boot design is not important. It does not help to reduce the chance of a sprained ankle as shown on some tests. Steel toe design has more shortcomings than benefits, if you are not going for alpine climbing. Normally, when we walk, the big toe bends up around 60 degree. If you wear a shoe which forbids your forefoot from bending, you have to increase the tibial rotation and femoral internal rotation and reduce the push-off phase (stride length) in order to keep walking a straight line. This will increase the tiredness and the pain on the big toes, knees and the ankles.

The above is a basic analysis. If you are interested in knowing more, you may look into books and researches written by experts such as Clark TE, Subotnick SI, NiggBM or Stacoff A.

Apart from this, the influence of the running shoe designs on different injuries is a very complex topic and I look forward to discuss again. Besides, from my clinical experience, tailor-made insole is more important than find well-designed shoes. You may also ask for advices from physiotherapists, prosthetic or orthotist.



對頁上圖：穿着了不適合腳型和用途的鞋容易引致傷患；下圖：鞋底不同的坑紋設計可配合不同運動項目的需要。Opposite top: shoes that do not suit your foot type or the usage will cause injuries; below: different grain designs to suit the needs for different sports.

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