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For many of the brave and hardy runners on Sunday at the London Marathon it will be their first attempt at the distance and they are therefore entering into the unknown, whilst for others they have embarked upon the challenge before and are looking to improve upon previous performances. All of these runners have hopefully put themselves through a lengthy training programme to prepare for the day, and during this period they will have been bombarded with information from running magazines, sports technology and footwear companies and their fellow runners about the best way to run, the best kit to wear, how to avoid injury and how to increase performance. One of their biggest challenges is to fight their way through all of this information and pick out the bits that are most relevant and useful to them without being confused by the rest.

There is an ongoing debate amongst the scientific and running communities about what is the best way to run? The catalyst for this was an article published by Professor Dan Lieberman and colleagues in *Nature* in 2010. They put forward a logical and well-reasoned argument that humans had evolved to run with no shoes on their feet, and the development of the built up sole of the modern training shoe had changed the way we run. Data were presented that showed that the Kalenjin tribesman, who routinely run barefoot, do not strike the ground with their heel, but with the ball of their foot, because it hurts to strike the ground with your heel. Whereas, the majority of people running in modern trainers strike the ground with their heel as it is protected by a large, built up sole and the heel of the shoe is physically closer to the ground and therefore more likely to strike the ground first. It has been proposed that this change in foot strike pattern could potentially reduce our running performance capability and increase our risk of getting injured.

To evaluate this argument it is important to understand how the leg functions in running. When we run, we bounce along from one leg to the next. When each leg strikes the ground some of the energy of that impact is stored within the elastic structures of the leg (tendons and ligaments). When that leg pushes off the ground again the elastic structures recoil and that energy is recycled to help power the runner into the next stride. This mechanism is hugely important to the efficiency of running and is one of the reasons why, as a species, we can run for very long periods of time compared to many other animals.

The part of our foot that first strikes the ground when we run has the potential to influence which of the elastic structures in our leg can be used to store energy. When we strike the ground with our heel the majority of the energy is stored in our Achilles tendon, but when we strike the ground with our forefoot there is the potential for some energy to also be stored in the elastic structures of our foot. This could mean that more of the total energy of impact is stored rather than having to be absorbed by other tissues in the leg. However, in order to control the foot during a mid or a forefoot landing it is necessary to generate more force with your calf muscles, which can be tiring. So there is a trade-off between the potential energy advantages and disadvantages.

If those are the theoretical arguments how do they translate into practice? A number of studies have shown that the majority (approximately 80%) of endurance runners who wear shoes will strike the ground with their heel. However, if you look at the group of elite runners who will start and finish the marathon first on Sunday you will see that the majority of them will not run with a heel strike, they will strike the ground with the middle or the ball of their foot. A conclusion from this could be that better runners are more likely to be mid foot or forefoot strikers therefore this must be good for performance and minimising injury risk. However there is a slightly complicating factor at play here: speed. The top finishers in the marathon will be running very much faster than the bulk of the field, and as we run faster we are all more likely to

shift to forefoot strike running style. Think of yourself as you increase your running speed from a jog to a sprint – you will probably strike the ground with your heel when you jog, but run on your toes when you sprint. The reason for this is that when you are running very quickly there just isn't enough time to swing your leg far enough in front of you to get your heel onto the ground in each stride, so you put your toes down first. Elite marathon runners are running at an average speed of around 20km/h which for most of us would be pretty close to sprinting, so it is no surprise that most of them are not striking the ground with their heels! Unfortunately for most of us, we do not have the muscular or physiological capacity to maintain this sort of pace for 26.2 miles and are therefore have a greater flexibility in the way our feet can strike the ground.

A number of research studies have investigated whether one type of foot strike is more efficient than the other, (i.e. it takes less energy to get from A to B) and the outcome of these has been that runners are most efficient in the running style that they naturally use. So the advice to those preparing specifically for a marathon should be to stick with the running style that they naturally use as this is what will be most efficient for them at that point in time. If they would like to explore a change in style to see if it can help them to run more quickly there needs to be a lengthy adaptation period so doing this in the run up to a big race is not a good idea!

A change in running style can be brought about through a training intervention in which a new technique is taught and practiced. Many of the footwear companies are marketing minimalist shoes to help with this process. These aim to mimic a barefoot situation, in which the foot is more flexible than in a traditional modern trainer, but provide some protection to the sole of the foot. A recent study has demonstrated that these minimalist shoes can help to cement a change in technique away from heel striking, as when wearing them heel striking is painful. But this is by no means an essential part of a technique change and it is perfectly possible to implement a change in running style without changing your shoes.

The final element of running style to note is that any change in running style will alter the distribution of load across the bones, muscles and tendons of the legs. Therefore for those runners who have had persistent injuries such as shin or knee pain, a subtle change in running style could help to alleviate the loads on the troublesome structures, potentially reducing the pain. But again, it must be stressed that any such change should be undertaken gradually as a sudden change in training load or running style is likely to cause far more problems than it will solve!