

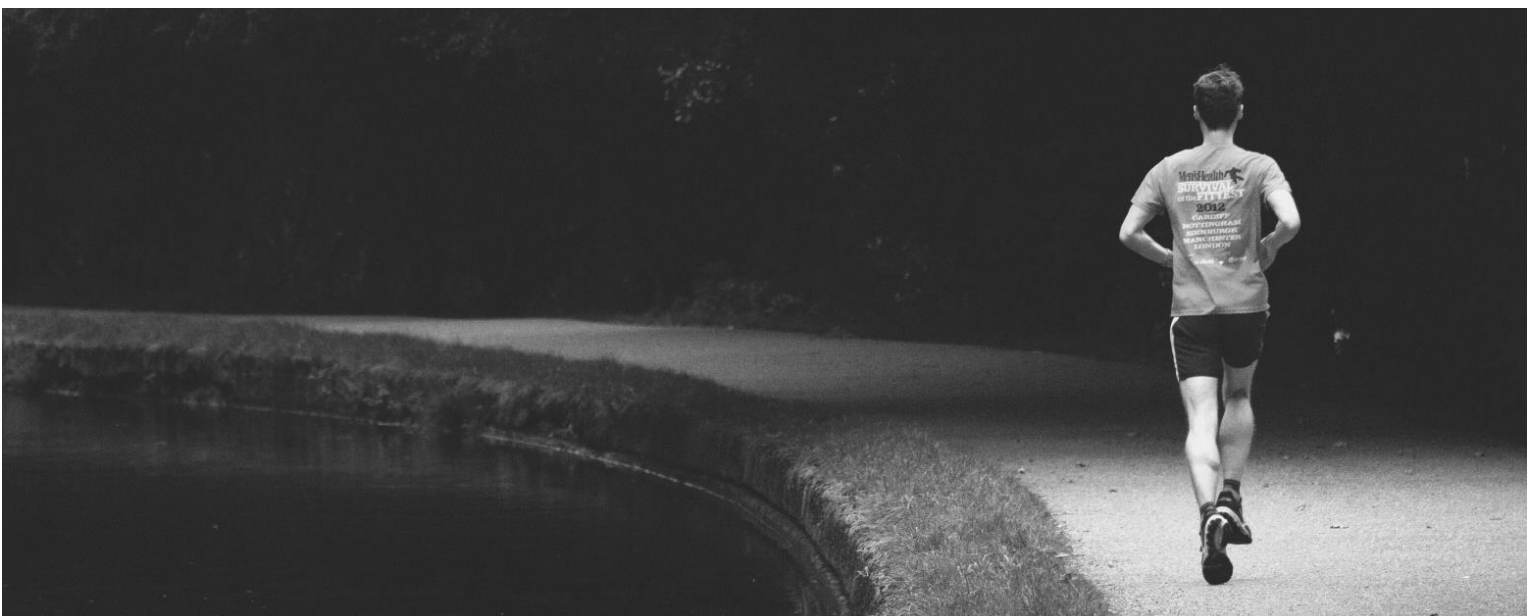


GAIT ANALYSIS REPORT

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CONTENTS

1. Gait Analysis Summary
2. Foot Strike
3. Hip Drop (Trendelenburg Gait)
4. Triple Extension and Pelvic Tilt
5. Arm Action
6. Recommendations

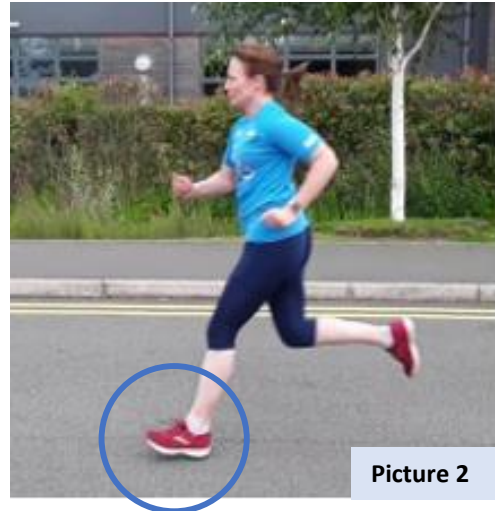
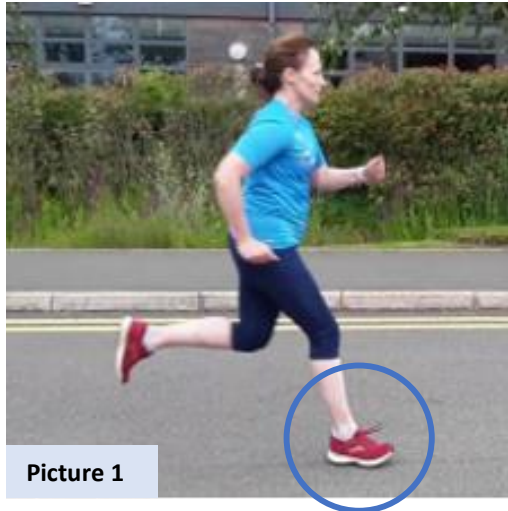


GAIT ANALYSIS SUMMARY

Please find below my report on the findings from your gait analysis. Firstly, a few summary points:

- I believe that your method foot strike is the main factor contributing to your right heel pain, but your landing position is good.
- Whilst I think your overall pelvic stability has improved, there may still be some work to do in strengthening your obliques and glute medius muscles and bettering your technical ability.
- There is tightness evident in your hip flexors which may be affecting your ability to drive backwards as part of the triple extension.
- Your arm swing has improved, but some minor improvements are suggested.

FOOT STRIKE



Perhaps the most important finding I discovered relates to your foot strike, and this could go a long way to explain the mechanism behind your longstanding calf and Achilles/heel pain. Interestingly, on your symptomatic side (R), you are striking with your midfoot (i.e. the forefoot and heel come down together), as shown by Picture 1. Conversely, you are striking further back towards your heel on your left side, as illustrated by Picture 2. This was the case when running slower and faster.

Forefoot and midfoot striking load the posterior tissues in the lower leg (i.e. the calf, Achilles, and plantar fascia) due to the need to subject these areas to eccentric lengthening stress upon touchdown in order to dissipate the load (eccentric movements are when the muscle is contracting whilst lengthening, which is shown to create more microscopic damage to the tissues, which is why it causes greater post-exercise muscle soreness due to the increased breakdown).

If the eccentric stress becomes chronic, it could tighten the posterior complex and create pain in these areas. These modes of foot strike are also shown to place greater stress on the ankle joint (i.e. the area in which you experience issues), as opposed to heel striking, which loads the knee more.



Picture 3

This finding also explains why your calf muscles seem to have undergone a lot of hypertrophy (muscle enlargement), even without a focus on specific hypertrophy resistance training. This is likely simply from years of chronically overworking your calves from this method of foot strike.

Picture 3 shows this muscle tone – you can clearly see the two gastrocnemius heads, and the soleus underneath on the driving left leg.

Considering this, my recommendation is to break the habit of striking with your midfoot on your right foot, and to switch to a heel strike, more like how you currently land with your left foot.

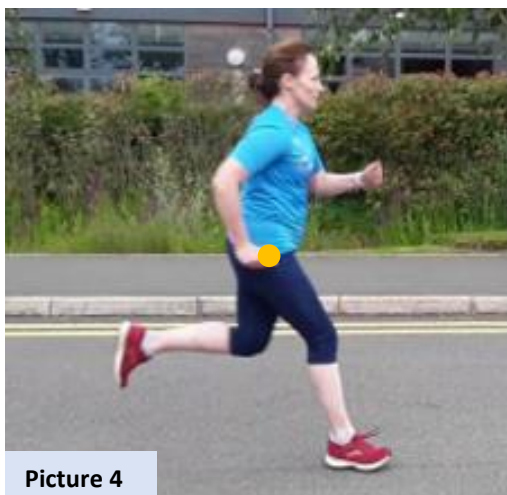
Heel striking often gets a bad name, however I feel this is very unjust. What you have to remember is that: 'different running techniques load different tissues differently in different runners'. This essentially means that there is not necessary a right or wrong, one size fits all foot strike that everyone should use, as it depends on the specific biomechanical characteristics of the individual.

I mentioned above that forefoot and midfoot striking primarily loads the ankle and posterior lower leg tissues, but this is exactly where you are getting your problems! Therefore, it makes sense to change the load to where your issues are not present, via a heel strike (unless sprinting of course). This will primarily load the Anterior Tibialis muscle (in the shin), and the knee more, hence, where you do not have any issues.

This is also a good argument to change your running speeds, and not run at the same pace all the time, as in order to not load the same areas all the time, you could heel strike on your longer, steady runs, while your intervals and sprints can still feature a forefoot/midfoot strike.

Heel striking in itself is not typically shown to be less efficient in the research evidence, however it can be if not done properly, and runners not executing this skill effectively tends to be the reason I intervene, as opposed to them performing it in general.





Picture 4

The mistake that is often made is that at foot strike, the foot is placed out in front of the body, with the knee extended. This means the foot is landing in front of the body's centre of mass (where the most bodyweight is concentrated), which is highlighted by the yellow circle in Picture 4 below.

If the leg is extended too far out in front of the centre of mass, it provides a braking force. Newton's third law of motion states that: "for every action, there is an equal and opposite reaction".

This means that if you put your leg out in front of you, the ground reaction force that comes back up through the floor will be pushing you backwards. Therefore, we need a short stride at the front, with a nice long stride at the back to be efficient – if we exert force behind us, the resultant ground reaction force will propel us forwards (this is covered in more detail in the Triple Extension section).

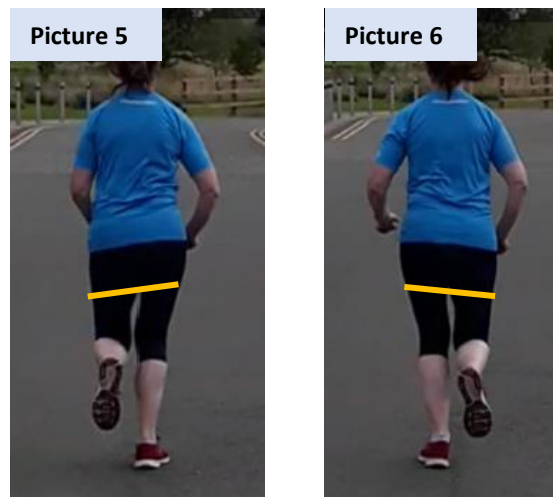
You can see what I mean in Picture 4, as your leg is quite close to being directly below your centre of mass, and your knee is slightly bent.

If I were to be very picky, I feel that you could improve this slightly by bringing your foot even closer to your centre of mass, however I do not think this is a top priority.

HIP DROP (TRENDELENBURG GAIT)

The following two sections will address your pelvic stability, which I think can be improved. Pictures 5 and 6 show what is known as a Trendelenburg gait, or a contralateral hip drop. This is where the hip of the contralateral side drops down (i.e. the side with the leg that is not is not currently weightbearing).

As the yellow lines show, the pelvis drops down to one side, and this is usually caused by a weakness in the glute medius and/or the oblique muscles.



Picture 7 displays an example – if the right hip is dropping, the right glute medius is likely unable to contract enough to pull the pelvis down on the right (red arrow), and subsequently lift the pelvis on the left.

Also, the left oblique muscles could be too weak to raise the pelvis on the left (blue arrow). This is not only inefficient, as it compromises a nice and tall, effortless running action, but it also places excess lengthening stress into the lower back of the contralateral side (e.g. the QL muscle). This could explain why you sometimes experience tightness in the lower back first thing in the morning. This also works vice-versa, and you can see a see-saw effect occurring about the pelvis in Picture 7.

Picture 7



Based on the large amounts of glute medius strengthening you have been doing during lockdown, I believe that these muscles are much stronger than they were.

You can even see in Pictures 8 and 9 below that your knees are no longer brushing together like they once did (i.e. the 'knock-knee' stance').

This would suggest that the glute medius muscles are stronger than they were. However, bear in mind that there may still be improvements that need to be made, especially as during the months of lockdown you have not been able to work the muscles against a greater resistance in the gym.

You also have not been doing as much in terms of oblique strengthening, so I would recommend continuing with that.

Picture 8



Picture 9



I have included the 'Hip Hitch' exercise to begin to strengthen the obliques, but I feel this will also be value from a technical perspective. From the amount of strengthening work you do, I believe you are much stronger than you once were and stronger than the vast majority of runners. However, I believe that your technical ability is comparatively lower from your difficulty in mastering the coordination of technical drills. After all, you may now be much stronger, but you still need to retrain your brain so you do not stick to your old bad habits. Therefore, I am hopeful this exercise will help you 'get a feel' for holding the pelvis in neutral.

TRIPLE EXTENSION AND PELVIC TILT

The other issue with your pelvis, is your difficulty in holding it in neutral. When running, your pelvis often migrates forward into an anteriorly tilted position (a forward tilt).

This is illustrated in Pictures 10 and 11, which are taken in the slower and quicker conditions, respectively. The yellow lines in these pictures show how the pelvis has deviated.

This is something I have pointed out to you in the past regarding your everyday posture, as you typically also adopt this pelvic position when standing and walking.

This too could also explain your occasional lower back discomfort, especially as you mentioned it feels like you have an excess arch in this area. This is because as the pelvis moves forwards, it creates a hyper-lordosis, which is an excessive curvature of the lower back (shown by the orange curves). This puts excess compressive force through the lower back and overworks the muscles in this area.

This biomechanical dysfunction is common and is often caused by a deactivation of the core and a tightening of the hip flexors. This makes sense, as sitting at a desk for long periods (which you do as part of your job) chronically shortens the hip flexors, affecting their flexibility.

Although you now have a very strong core, I think activating these muscles is made difficult due to the tightening of the hip flexors, and the fact that despite your impressive strength, you still struggle with activating these muscles when running due to technical deficiencies (as I mentioned above).



This finding is also related to your ability to perform a triple extension movement. The movement involves hyperextension of the hip, extension of the knee, and plantarflexion of the ankle, respectively.

This is related to Newton's third law; which I referred to earlier, as a long stride at the back will propel us forward due to the equal and opposite reaction, which is why it is important to have a short stride at the front, and a long stride at the back.

The triple extension should allow propulsion of the body at an approximately 45 degree angle to ensure maximum distance. Think of it like attempting to throw a ball as far as possible – to do this, it should not be too low or too high, therefore 45 degrees will result in the furthest throw. Now think of your body as that projectile. Picture 11 should help you to visualise this.



You may have noticed a stark difference in the quality of your triple extension between the slow and quick conditions in Pictures 10 and 11, respectively. This is yet another argument as to why it is necessary to vary your pace, because as you can see from Picture 10, the slower condition has lesser hyper-extension of the hip, and therefore lower glute maximus contribution (this is the muscle responsible for hip hyperextension). This causes an increased knee bend as the hamstrings are now working instead. This may trigger muscle imbalances and increased posterior chain tightness, which in turn may negatively influence your heel pain through a tightening of the fascia.

Conversely, Picture 11 demonstrates a better-quality triple extension when running faster, as quicker speeds result in bigger, more forceful strides. Here, although there is less of a knee bend, it is still present, so I would like to see you hold on to this triple extension for longer.

Notice from Picture 10 that the hyper-lordosis is greater than when running slower. This, I believe, is a consequence of your tight hip flexors, which pull the pelvis forward and increase the arch the lower back.

This position also places the glute maximus muscle in a sub-optimal position to activate, which can reduce the effectiveness of the triple extension by reducing power from the glute, and again can make the hamstrings step in to compensate. Therefore, I recommend some hip flexor stretching and strengthening to 'strengthen to lengthen' these muscles.

ARM ACTION

Picture 13



Picture 14



The final point is regarding the upper body. Since I last analysed your gait, your arm action has improved when running faster, but is still quite limited when running slower (which to a certain extent is unavoidable). This is illustrated by Pictures 13 and 14, respectively. However, I would like to see greater arm swing, as a good arm action aids forward momentum to drive the body forwards, and provides a counterbalance to the opposite leg to keep the body stable i.e. the right arm comes forwards with the left leg, and vice-versa.

Remember the 'socket to pocket' saying, whereby the range of the arm should travel between the hand being level with the shoulder socket, to beside the pocket on your shorts. Additionally, there seems to be a big difference in the maximum height your hand reaches when coming up in front of the body, as the left hand seems much higher (see Pictures 15 and 16).

This difference is greater when running faster and could create a muscular imbalance around the shoulders and problems due to a lack of mobilisation of the joint. However, it is worth noting that this imbalance is not evident when running slowly. Therefore, when running, try to focus on raising your right hand slightly higher.

Picture 15



Picture 16



RECOMMENDATIONS

- When running, try to focus on landing heel first on both feet, under your centre of mass. You may feel soreness initially in your shins as you start to work the tibialis anterior muscle, but this should pass as it begins to strengthen. I would recommend attempting this on your shorter, steady runs to begin with. Try the 'heel walk' drill to activate this muscle prior to running.
- Continue to strengthen your glute medius muscles with your home-based exercises ('side glute plank', 'glute side walks', 'clams' and resume heavier resistance exercises in the gym as soon as you can. Try focusing more attention on strengthening the oblique muscles ('hip hitch', 'oblique sit-ups').
- The 'High Knee' drill will allow you to develop greater power through your triple extension while working it through a greater range of motion. Try the 'leaping' drill also.
- Stretch the hip flexors to increase range through the triple extension (see 'hip flexor PNF' and 'hip and quad stretch'). Also, strengthen the hip flexors to 'strengthen to lengthen' (see 'resisted hip flexes' and 'flutter kicks').
- Try to increase the range of which your arms work through when running slower – remember 'socket to pocket' and keep the arms and shoulders relaxed. Also, try to make sure you swing your right arm more, so it is the same as your left.
- Sports massage is useful to manage the symptoms of your pain by releasing off your calves and hamstrings. I would recommend you book in regularly. After all, strengthening and gait retraining is necessary, but also takes time. Therefore, this will help you to manage your symptoms in the meantime. However, I would like to point out that it would not be wise to rely on sports massage in the long-term – the aftercare is what will fix you! I have also included some calf and hamstring stretching techniques to manage your dysfunction by improving your flexibility in these areas.
- As I have recommended a lot, I would not recommend trying to change everything all at once. Instead, think of the 'little and often' approach, whereby you spend around 10 minutes a day on your aftercare and stick to it. Aim to work on no more than one thing per session when improving technique, otherwise it will be information overload!
- I would also recommend a follow-up session in a few months' time to see how you are improving, and if any changes need to be made. I will contact you further down the line regarding this.

For you to access the videos for the exercises I have recommended above, I have created a folder for you to view on Dropbox. Here you can view or download the videos, and you can keep referring to this. I will also update it in the future should I need to.

Here is the link to access the folder:

www.dropbox.com/_____insert custom link here_____

I hope you found the session useful, and if you have any questions then please do not hesitate to let me know.

Gait analysis is something I am keen to promote further, so if you're happy with the service you've received, it would be great if you could recommend me to some of your running friends!

Regards,

Will Goodbourn

