Phits Design Clinical Guide

Provided by Gait and Motion Technology Ltd

This guide is to aid you clinically when applying corrections to your Phits 3D printed orthoses.
Please continue to use the **Phits Expert Guide** provided for further information on the design options.

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(Please note that this guide is provided by the Gait and Motion Technology Ltd support team based on their knowledge and understanding. Some clinical opinions may vary.)

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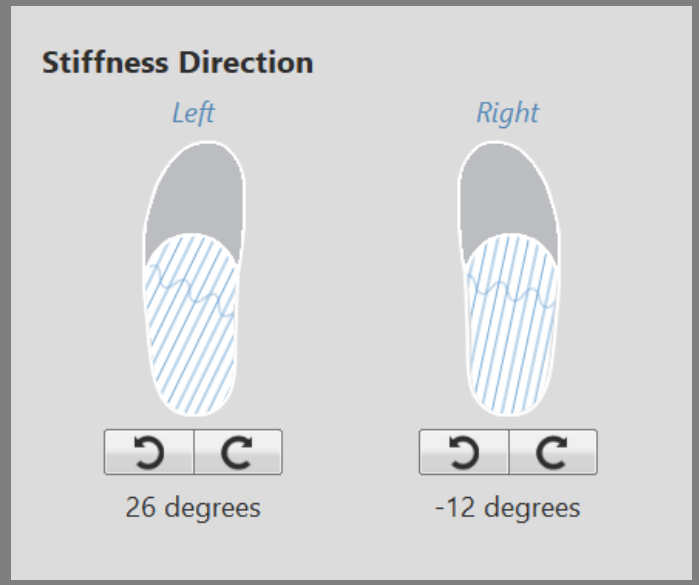
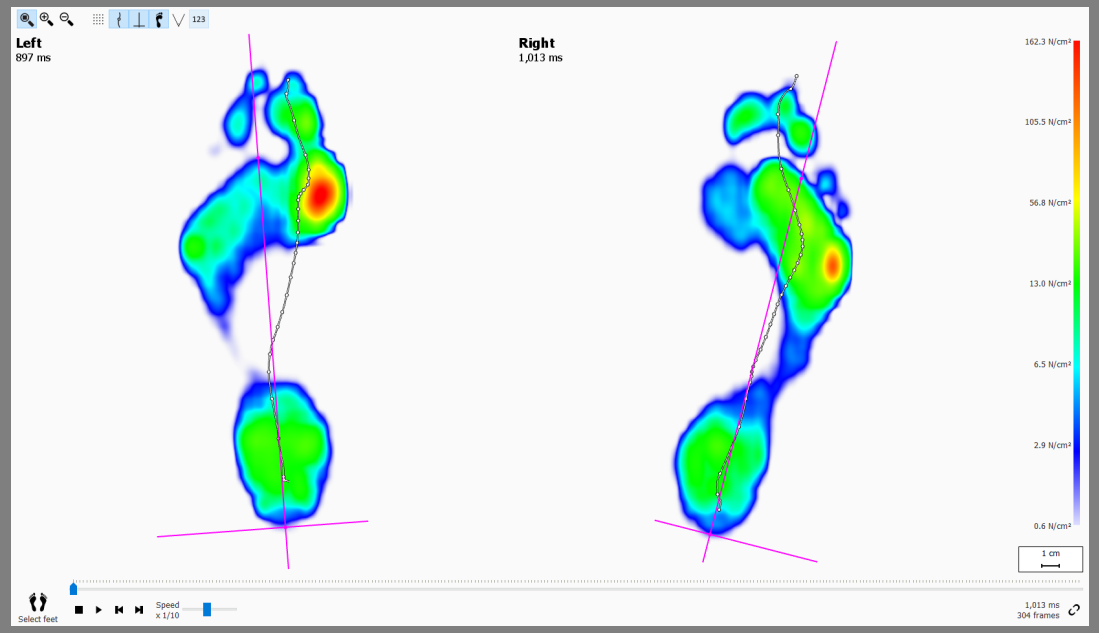
Stiffness Direction





This unique correction will guide the foot towards supination or pronation via torsional stiffness.

The range of correction goes from -30 degrees to +30 degrees.

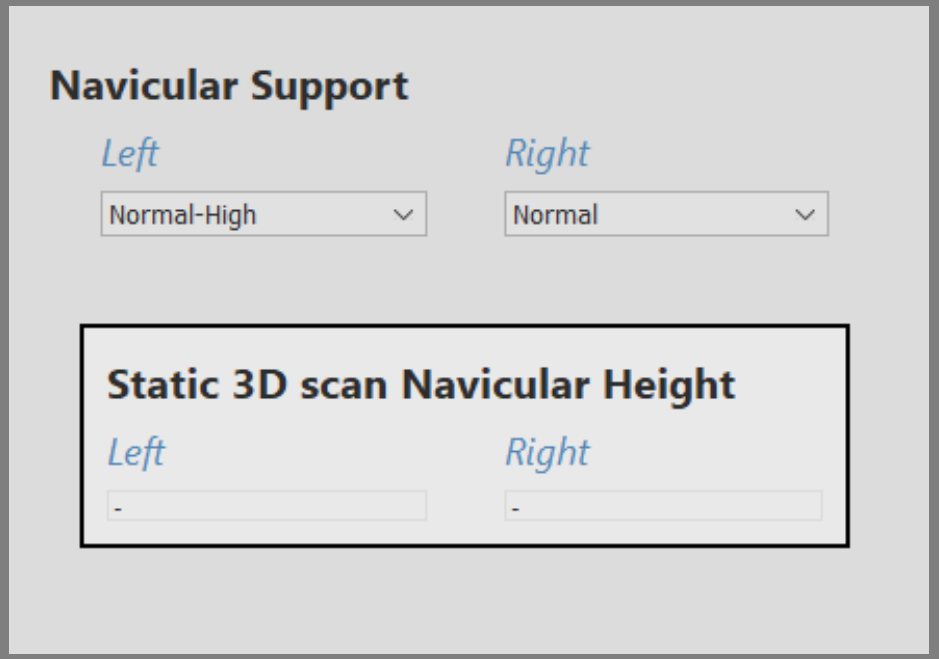
Positive degrees help to minimise pronation and negative degrees help to minimise supination.

This correction is calculated based on the forces applied on the metatarsals during gait and will be automatically generated based on the dynamic footscan data that is captured.

If there is more working on the medial metatarsals, the directional stiffness should show a positive degree to guide the foot more towards supination and vice versa.

It is advisable that this calculation is not adjusted due to the complex nature of the algorithm. However, as the clinician you always have the final say and if you feel that reducing or increasing the levels of directional stiffness will improve your patient outcome, you are able to tweak this.

Navicular Support

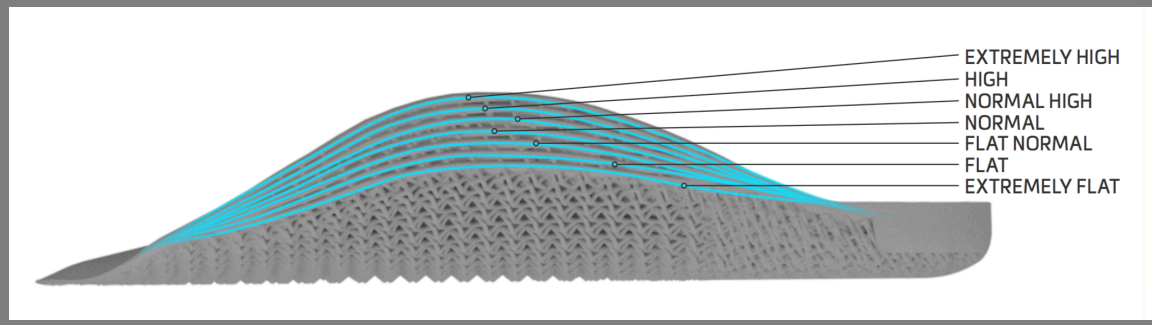


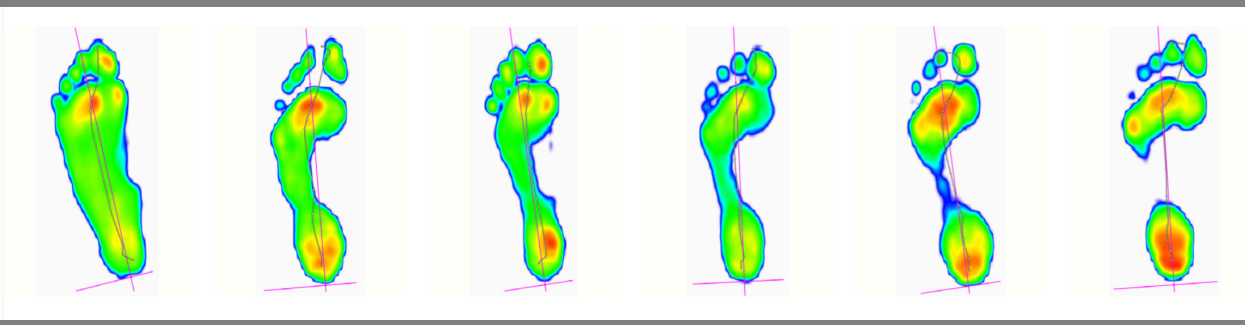
This is calculated based on the dynamic weight bearing data that is collected. There are numeric values behind the scenes, but for clinician and patient understanding, these heights range from extremely flat to extremely high.

This improves your ability to support the medial arch, an area commonly used to help control the foot by supporting the area just after heel strike. You can use this to slow the foot down to gain more control as the foot is transitioning to midstance.

Although this part of the prescription is calculated automatically, you still have the ability to increase of decrease the height if you wish according to your clinical diagnosis.

If you possess a static 3D scanner this data can also be used to aid your decision on the navicular support prescribed.





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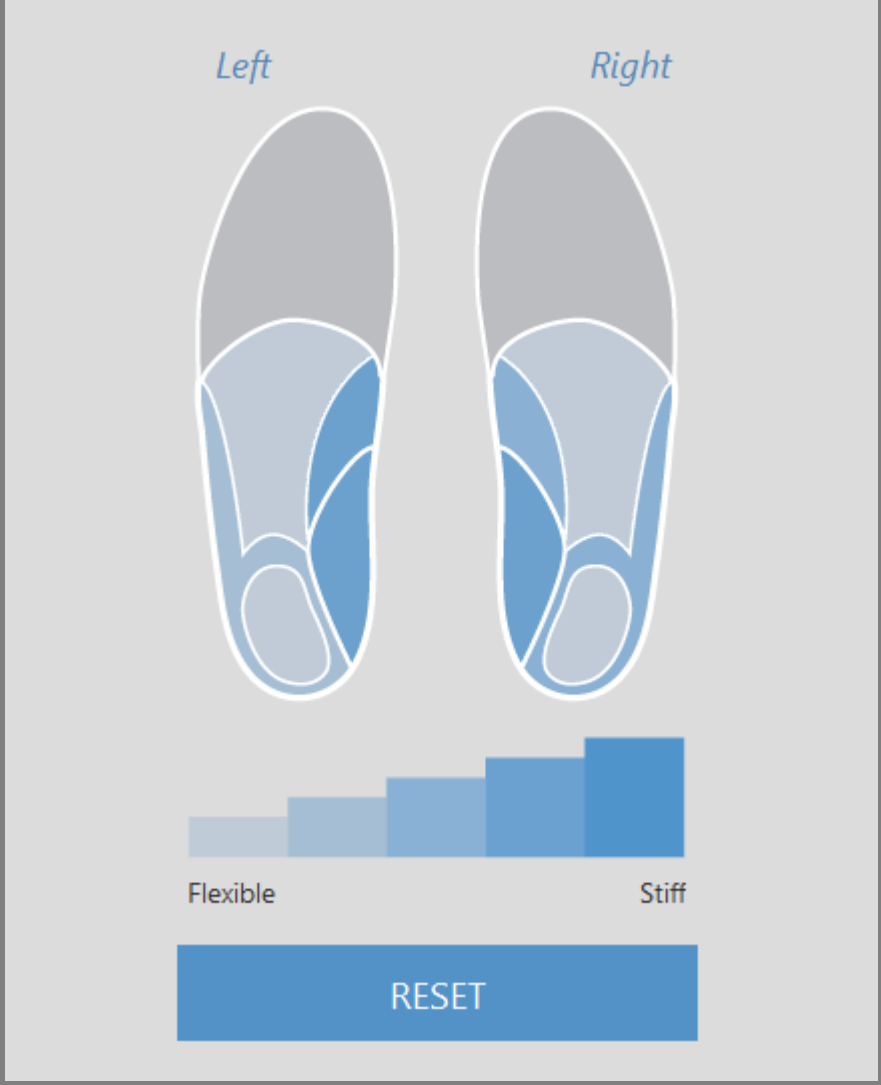
Local Stiffness



The local stiffness calculations are based on the foot roll-off, the amount of internal/external rotation and the weight of the patient. The stiffness ranges from 1, being more flexible (clear blue) to 5, being stiffer (dark blue).

Hovering over a zone activates the local stiffness controller, which allows you to tweak the local stiffness of each zone. By changing the local stiffness, you are able to modify the flexibility of the printed base in 5 pre-defined zones. By clicking reset you will see the suggested values again.

These adjustments give you real control on the design and functionality of the orthotic providing a truly bespoke device that applies the data to what you want the orthotic to accomplish.

Advice

Be cautious with level 5 stiffness values, especially for patients new to bespoke orthoses. Although biomechanically your patient would benefit from the suggested level of support, some individuals may find the level 5 too rigid. Reducing this to a level 4 will decrease the stiffness, but still maintain the desired level of control while allowing you as the clinician to err on the side of caution.

Heel Pads

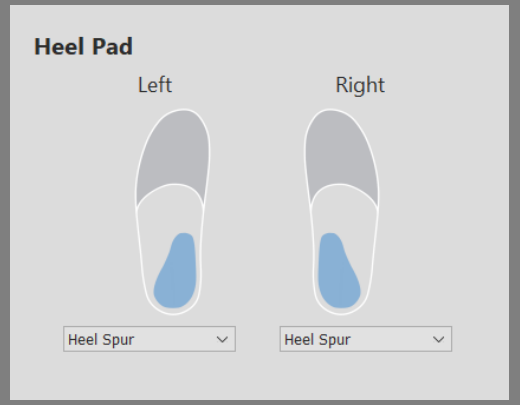
Heel pads can be applied to any Phits product that has an EVA top cover (shore 30,35 or 40). These pads can be applied to offload additional rearfoot pressure and provide additional rearfoot comfort. The following three heel pads target specific heel pain complaints…

Fat Pad

Traditional heel padding providing additional comfort throughout the heel cup of the prescribed device. Common in the management of all heel pathologies, Achilles complaints and shock attenuation issues throughout the lower limb.

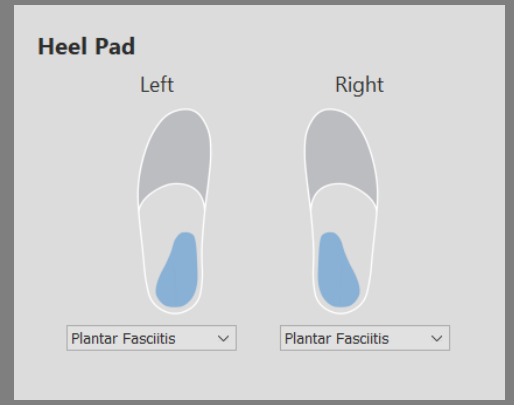
Heel Spur Pad

Provides additional comfort in the rear foot and helps to offload the bony prominence on the plantar aspect of the heel, associated with 'Heel Spur Syndrome'.

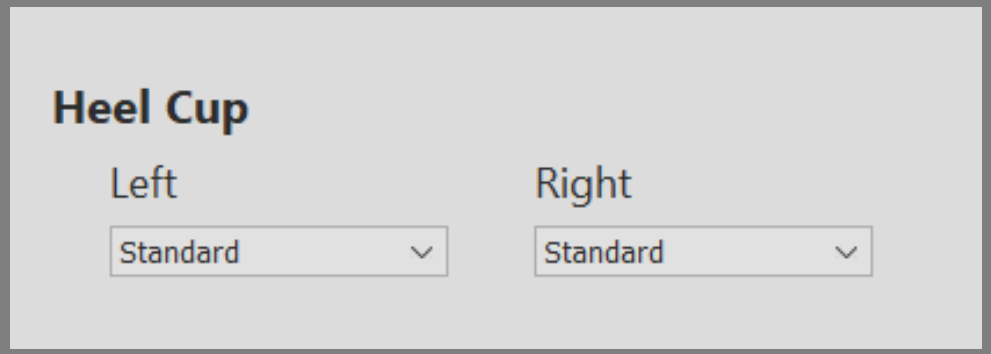


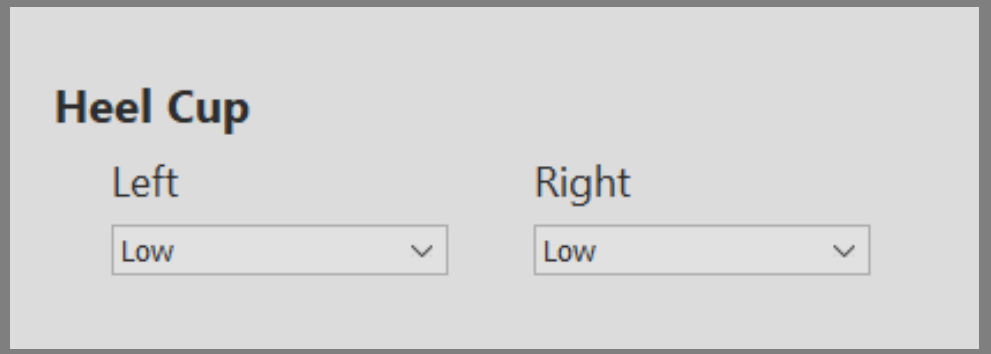
Plantar Fasciitis Pad

Plantar fasciitis is an inflammation of the fibrous tissue (plantar fascia) along the bottom of your foot that connects your heel bone to your toes causing pain. This pad helps to offload pressure in the entire heel area and is extended under the plantar fascia attachment.



Heel Cup





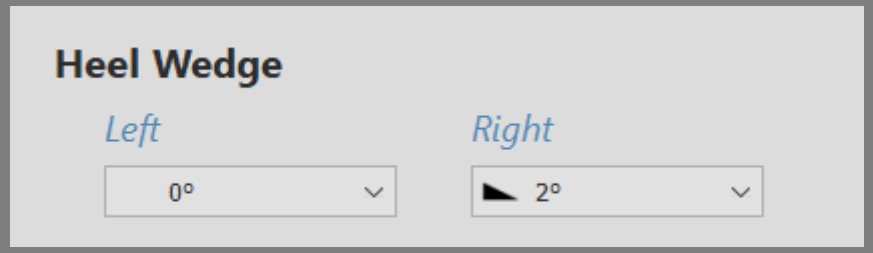
There are two options for heel cup depth, the default being ‘standard’ and a secondary option being ‘low’.

The main reason for reducing the heel cup depth to low is to aid the in shoe fit in unaccommodating footwear. The standard heel cup provides greater control to the calcaneus, especially in hypermobile foot types.

If your patient requires significant rearfoot control due to excessive pronation or supination we recommend using the standard heel cup depth to improve stability and control.

(Please note that when selecting the low heel cup option you will lose the ability to personalise the device.)

Heel Wedge



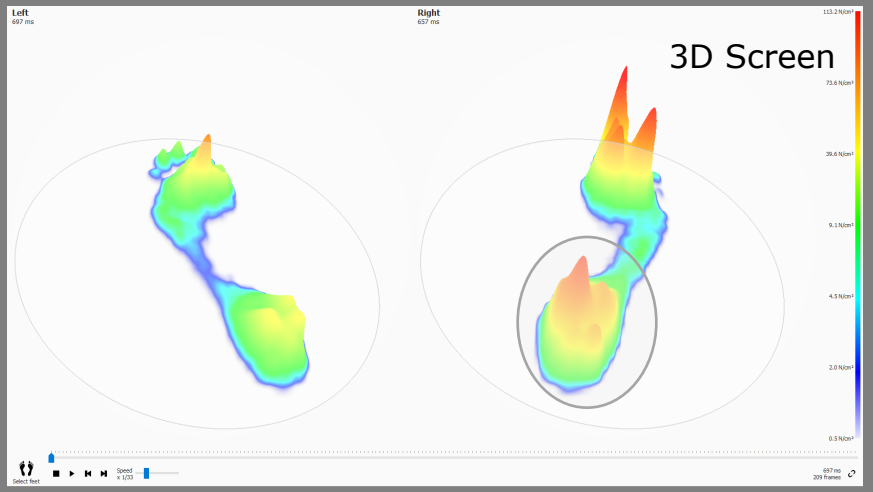
The extent of the medial (positive degrees) or lateral (negative degrees) heel wedge (otherwise known as rearfoot post) will be calculated by the dynamic force algorithms throughout the rearfoot.

For these calculations, footscan averages and evaluates the first 15% of the stance phase. This is commonly 'heel strike' to 'foot flat'. Depending on the difference between the force applied on the medial and lateral heel zone, a heel wedge will be proposed.

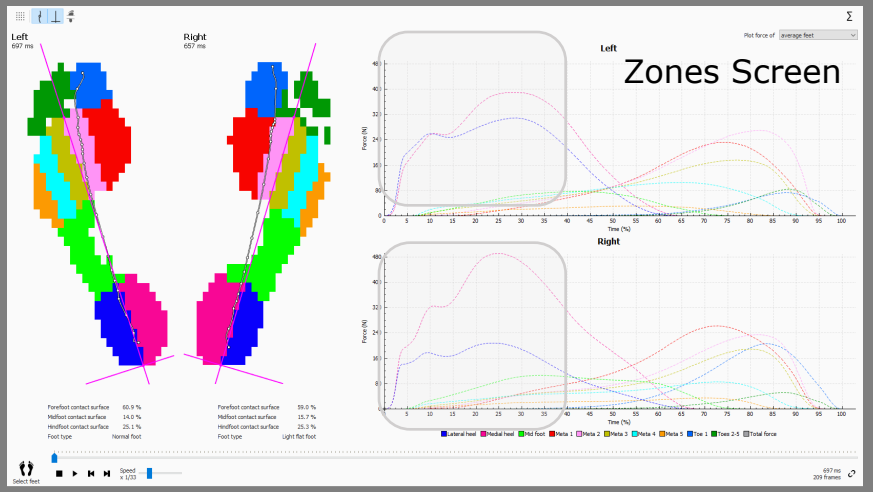
Although the heel wedge is calculated, we advise you to double check the result. If you think your patient could benefit from a heel wedge, you can easily overrule the prefilled value. If on the other hand a heel wedge is recommended but based on your expertise this doesn't make sense, you can easily remove the heel wedge. It is important to remember that the system and calculations are there to aid you, not replace you. Ultimately, you have the final say.

To control pronation, the system/yourself will apply a positive degree, lifting up the medial (inside) aspect of the heel.

To control supination, the system/yourself will apply a negative degree, lifting up the lateral (outside) aspect of the heel.

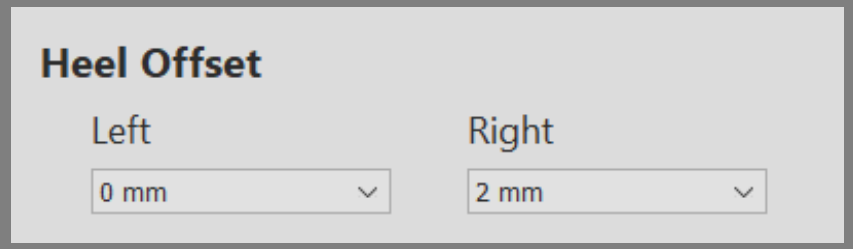


Example of excessive right foot medial pronation in the 3D analysis screen



Note the asymmetry between left and right. Pink = Medial heel. Blue = Lateral heel.

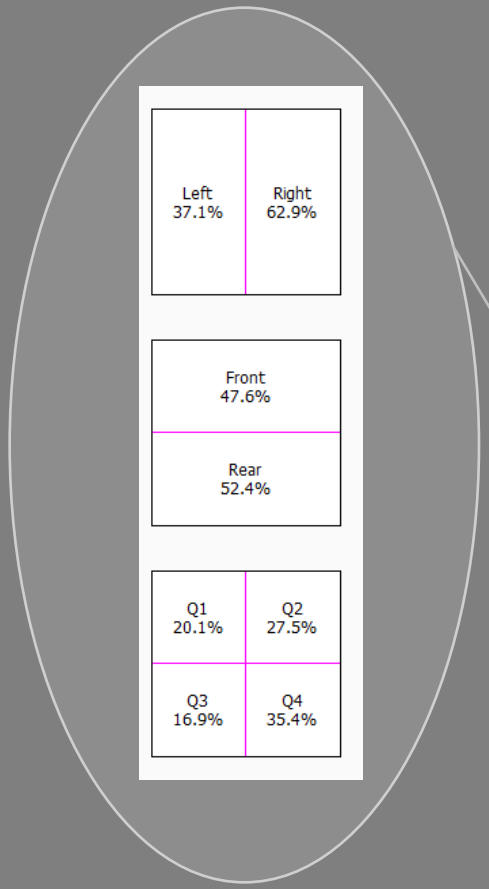
Heel Offset

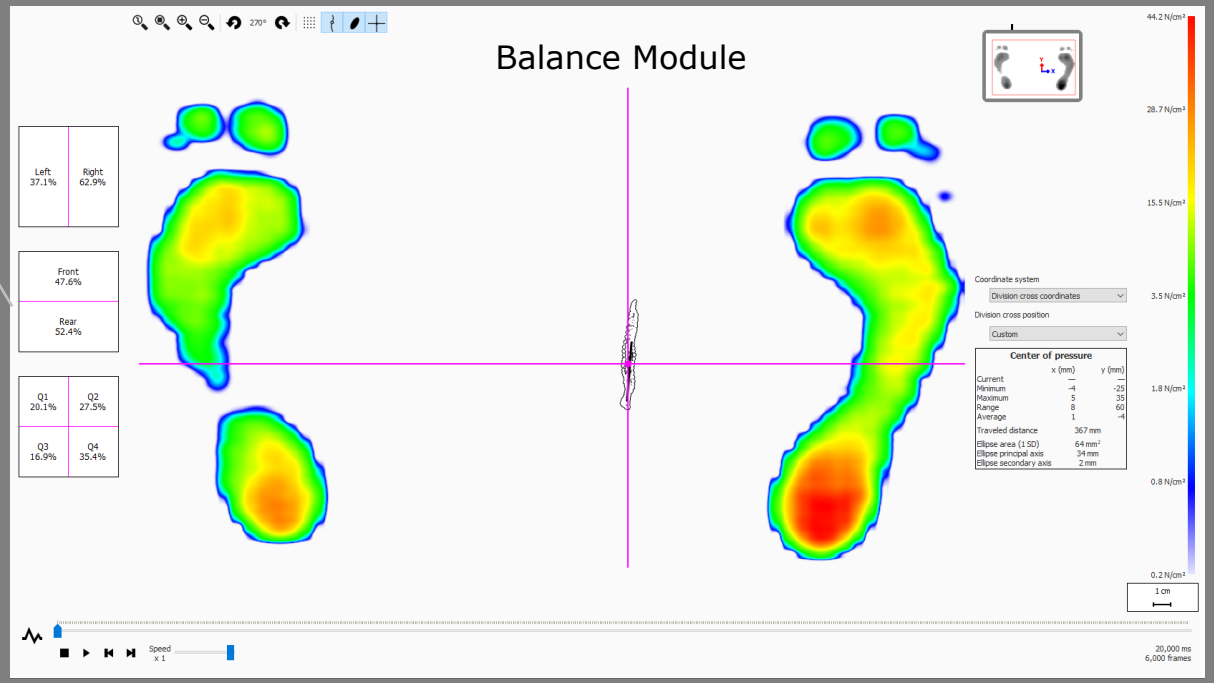


The heel offset enables you to apply a heel raise of up to 6mm to the device. This is applied as part of the 3D printed base and not as an external modification.

Although footscan can help to identify a leg length discrepancy (LLD) using the static/balance module, it is not validated to make an automatic calculation.

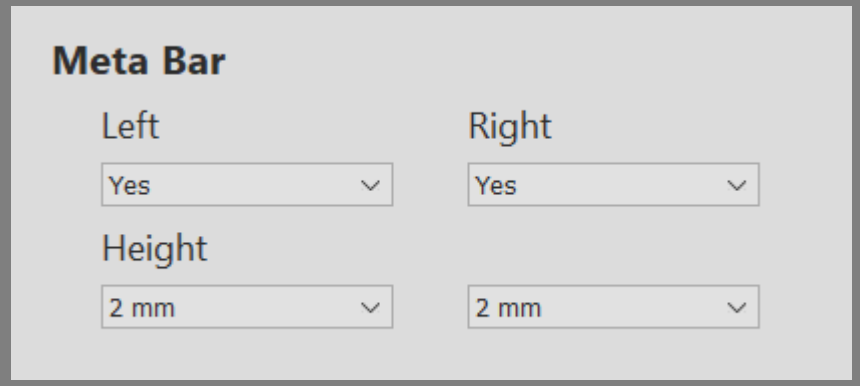
Carry out your typical physical assessment for LLD's along with using the footscan to guide you. The addition of a heel offset is your choice and a manual entry.





Example of the right leg showing a 62.9% weight/force distribution which could be an indicator of a possible LLD. More often than not, the higher percentage is shown on the shorter side due to a postural deficiency.

Meta Bar



Below is an example of elevated loading through metatarsals 1-5 due to dorsiflexion of the toe, causing additional forces through the met heads. This is a prime example of when a Meta Bar would be a suitable option. As a case study, this very patient went from not walking, to walking with this modification, along with some additional calculated changes.

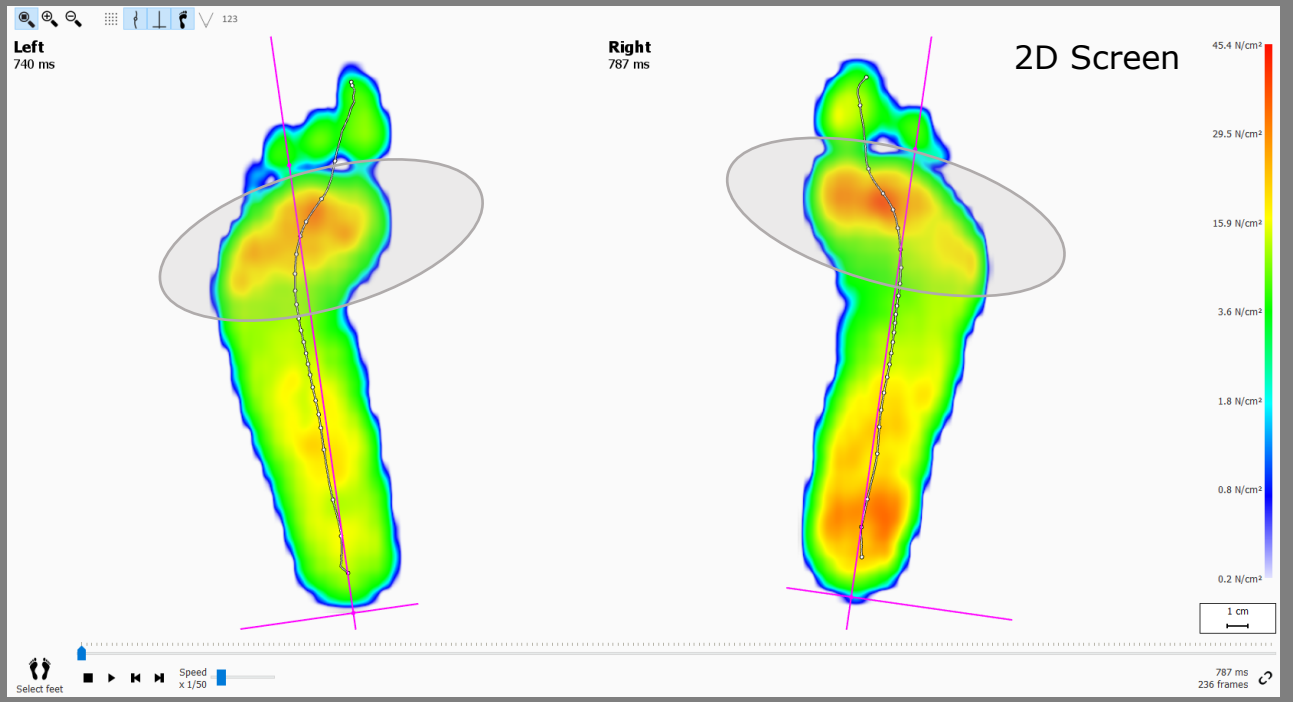
(Please see additional analysis screen shots on the following page.)

The Meta Bar is a metatarsal bar that is positioned just behind the metatarsal heads. It acts to distribute the load placed on the metatarsal heads by spreading the plantar pressures away from the peak pressures.

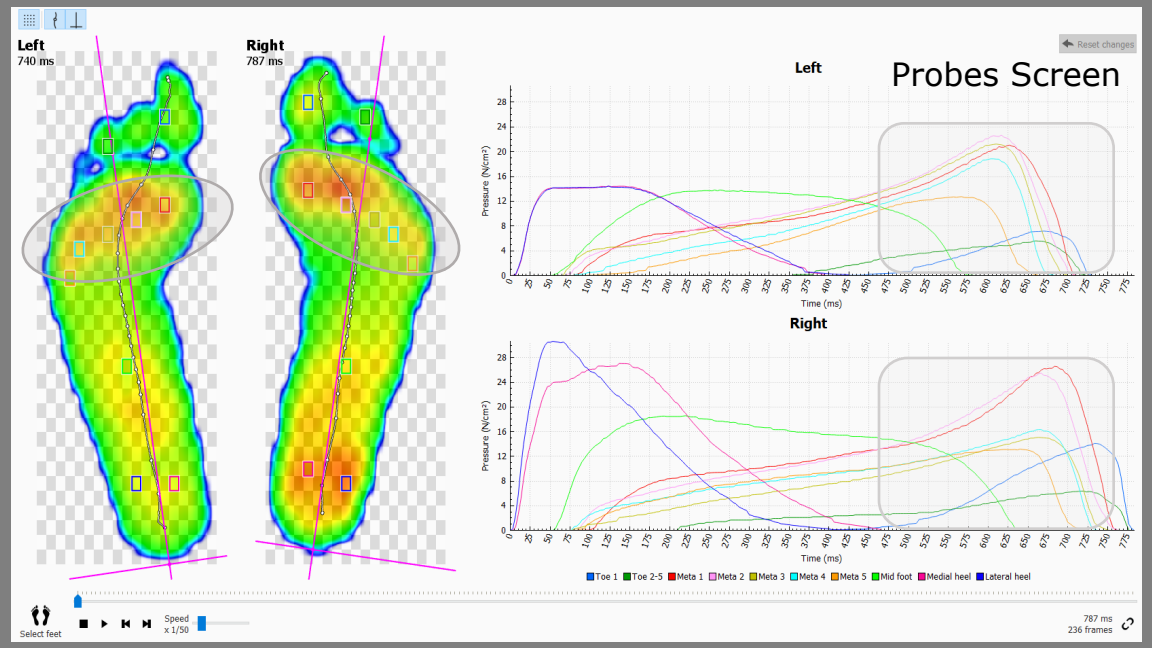
It also affects lesser toe retraction, as supporting the foot in this way also affects the plantar metatarsal pad by drawing it proximally and extending the toes.

By selecting 'Yes' and the preferred height of the metatarsal bar, you can add a general metatarsal support to the orthoses.

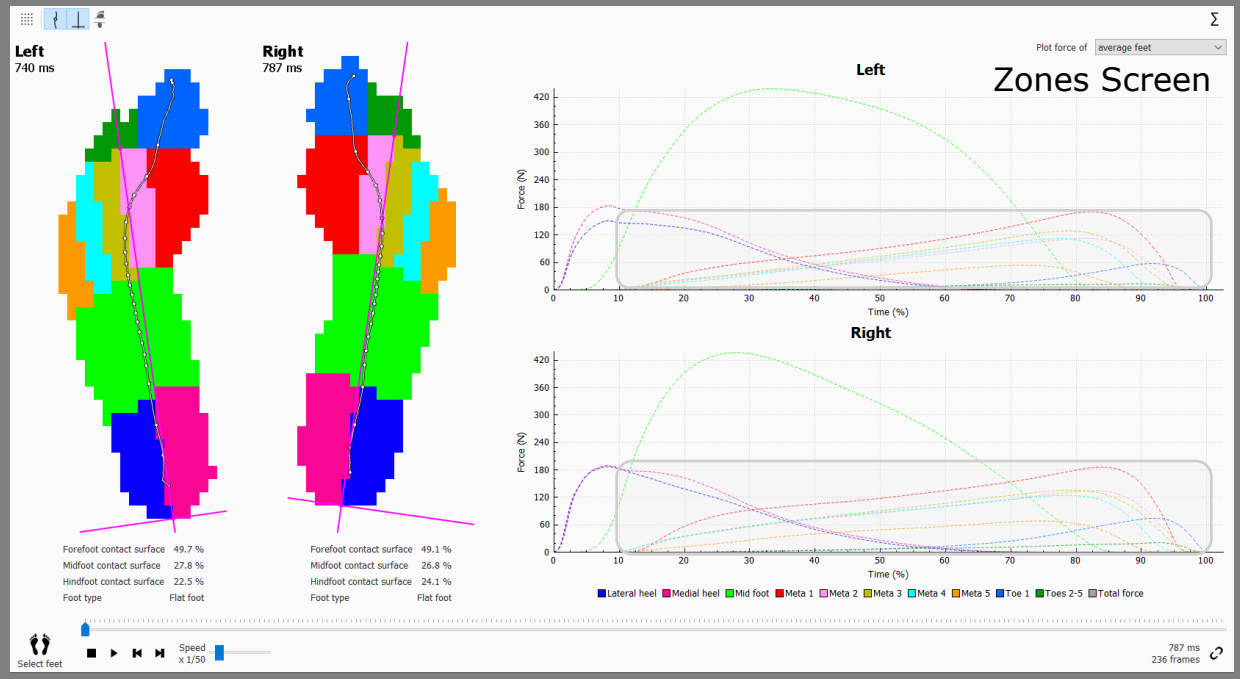
Note that this correction is only available for an ortho base type and is available in 3 heights: 1, 2 and 3mm.



Meta Bar

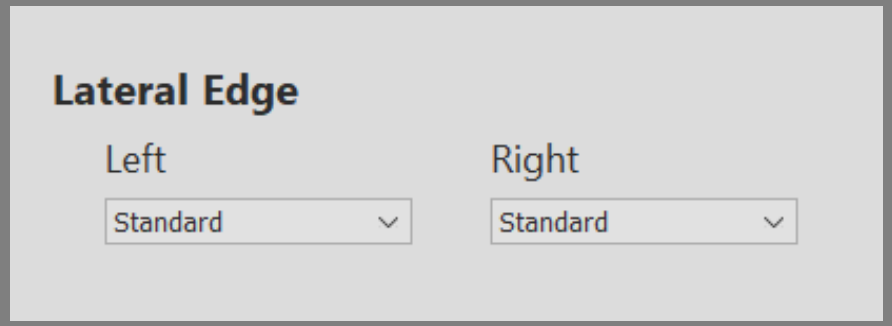


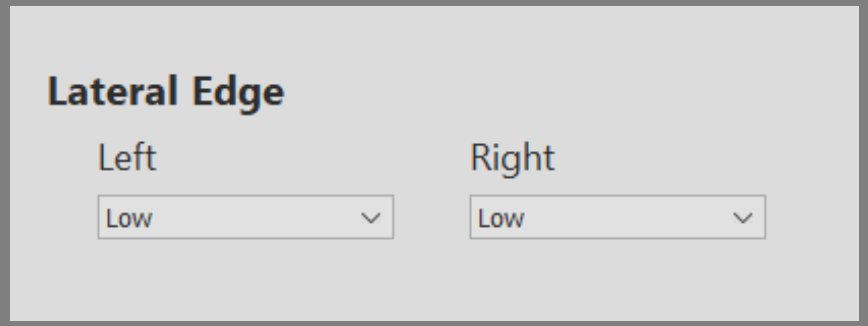
The Probes screen to the left indicates the levels of pressure being exerted through the metatarsal head regions, which is another indicator that the Meta Bar would be a good choice of modification. In this instance, a 2mm Meta Bar was applied bilaterally.



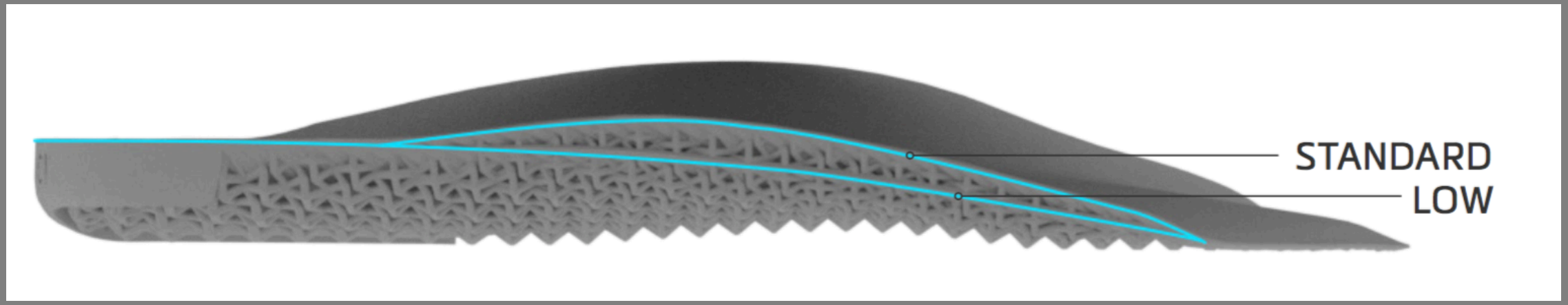
The Zones screen to the right is looking at an average of all of the patients foot strikes. As you can see from the data, although there is significant midfoot loading, the metatarsals come into ground contact very early on, causing major discomfort. The Meta Bar will look to redistribute the forces and encourage a more natural met head and toe function, thus reducing the pain complaint.

Lateral Edge





You can choose to lower the lateral edge of the printed base.
The difference between a low lateral edge and a standard lateral edge is visualized here:



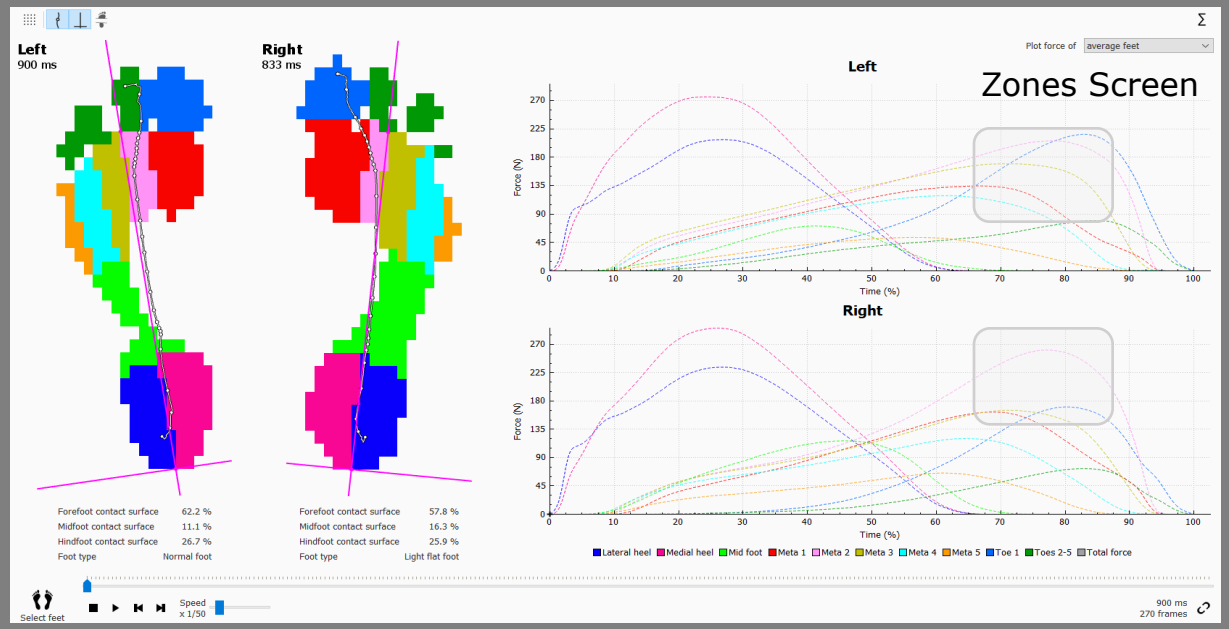
This decision to lower this is up to you as a clinician. A good reason for a low lateral edge would be a wide forefoot, a prominent base of the 5th metatarsal (Styloid Process) or cuboid. The goal is to avoid irritation of the printed base with the foot, due to the foot type of the patient.

Metatarsal Pads - Teardrop

The Teardrop pad is a teardrop shaped metatarsal pad that is placed just behind the metatarsal heads to re-establish the transverse arch, or positioned specifically to an intermetatarsal spacing to increase interdigital and intermetatarsal space. This can have an effect on neuromas as well as reducing peak pressures over the ball of the foot. The Teardrop is available in 5 heights from 1mm through to 5mm.

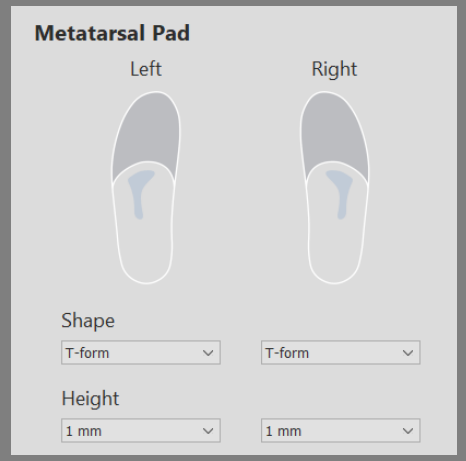
It is important to remember that this correction is created during the 3D printing of the device and is made from the same PA-12 material. This is a rigid form, so applying a larger pad in some cases could feel uncomfortable. In most cases a 1, 2 or 3mm pad would be clinically appropriate.

Above shows a central pressure load through the 3rd metatarsal. To reduce this, a teardrop would be ideal to splay the toes and reduce the 3rd metatarsal dropping.



The Zones screen above shows the increased force through the 3rd metatarsal which helps to quantify the findings within the 2D screen and patient pain/discomfort complaint.

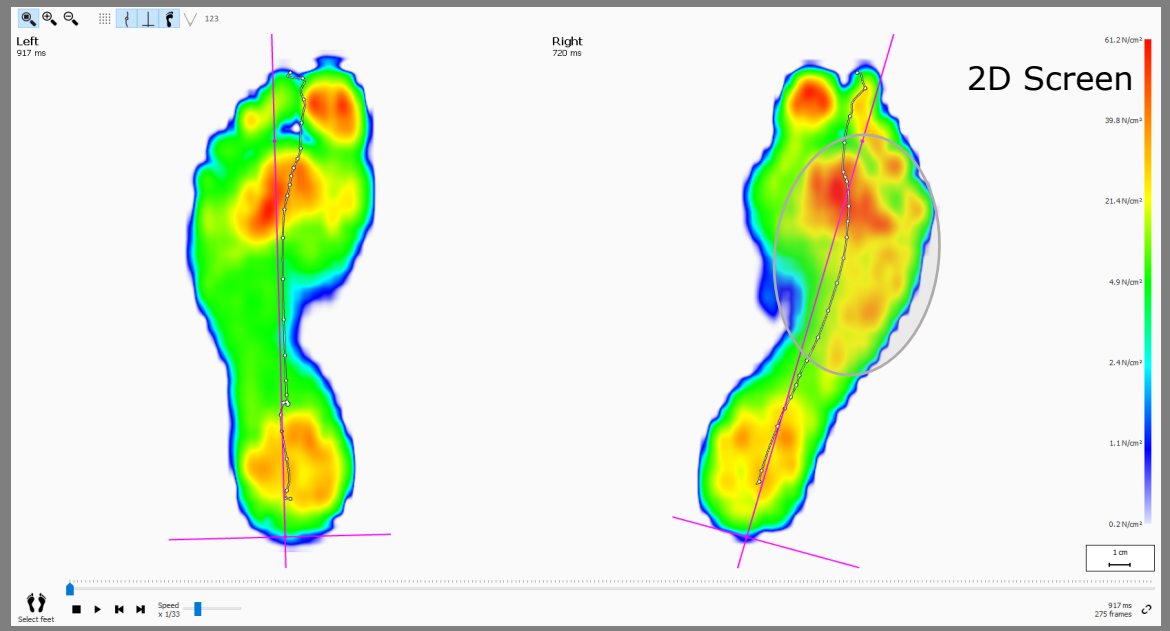
Metatarsal Pads - T-form



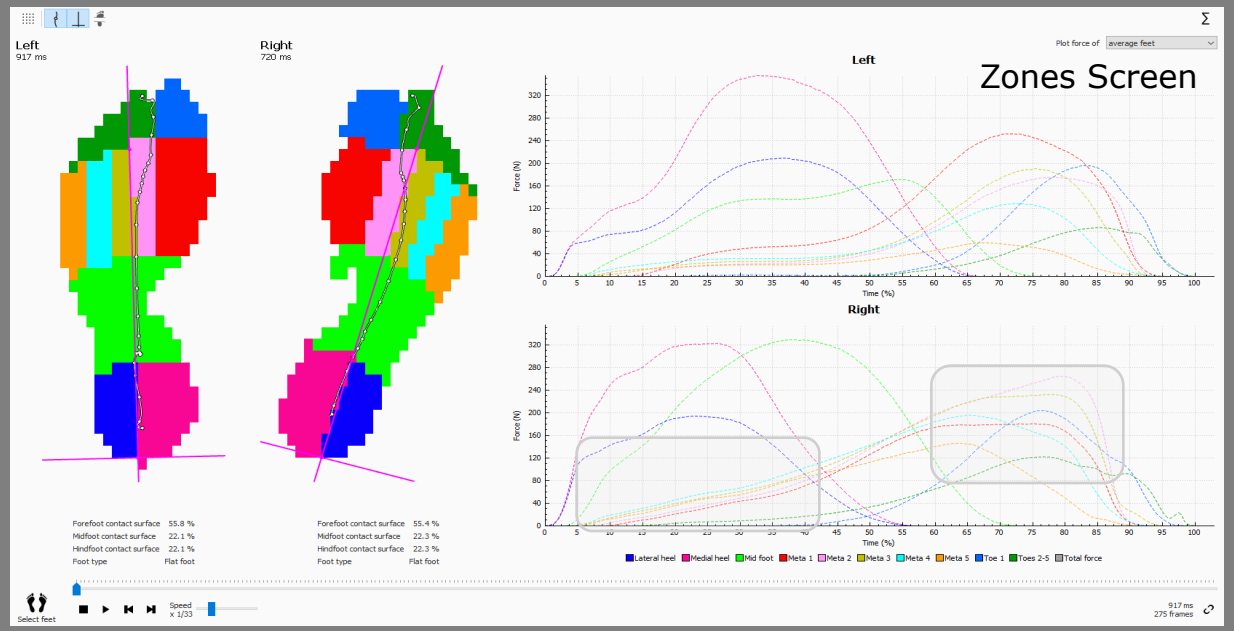
The T-form pad is positioned medial to the 5th ray and just behind the 2nd to 4th met heads. Its function is to support the 5th ray and midfoot to improve midfoot stability and is used effectively in hypermobile foot postures. It can also be used to help extend the lesser toes in clawing situations.

Similarly to the Teardrop, the T-form is available in 5 heights: 1mm through to 5mm.

It is manufactured from the same PA-12 material and is a rigid form, so applying a larger pad in some cases could feel uncomfortable. In most cases a 1, 2 or 3mm pad would be clinically appropriate.

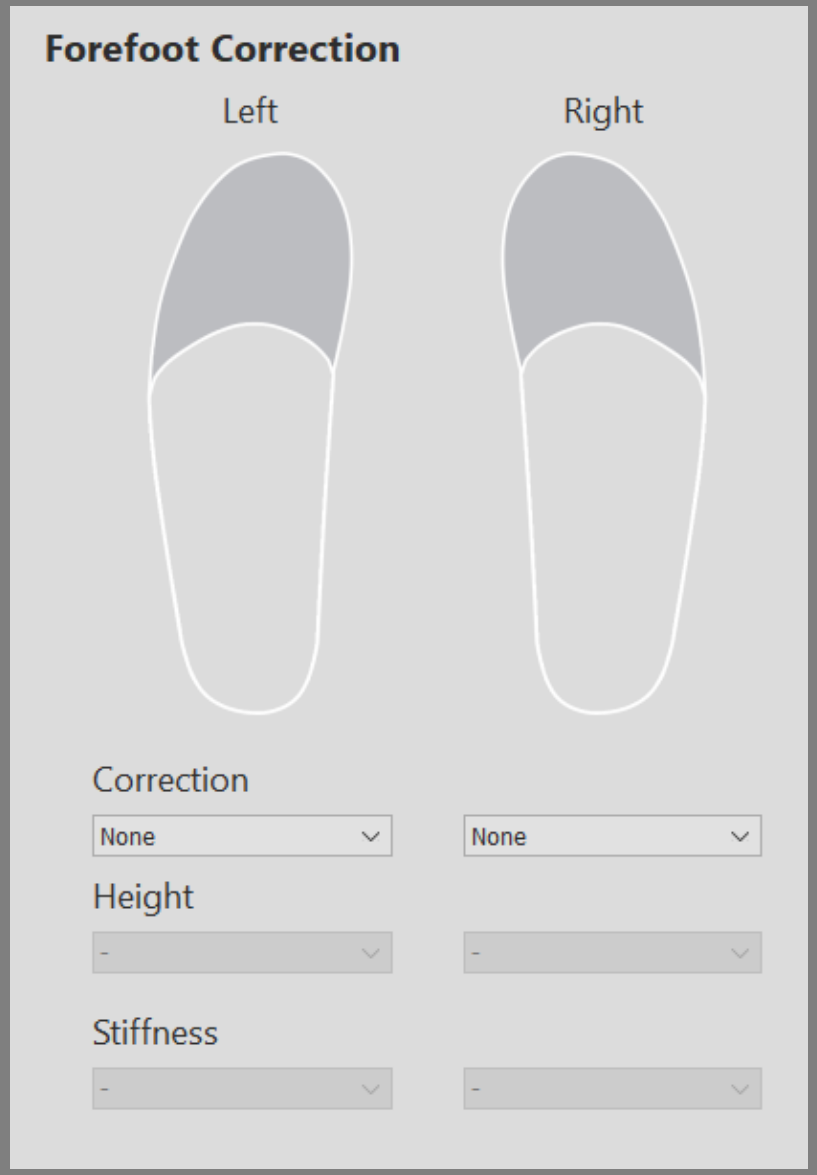


The right foot above shows a lateral load pattern through metatarsals 3-5 down to the 5th ray. A T-form can improve 5th ray function and reduce loading of the lateral metatarsals.



The Zones above also highlights the lateral forces through the right foot and early lateral forefoot contact around the 5th ray, leading to increased forces through metatarsals 3-5.

Forefoot Corrections



Although the forefoot corrections are not calculated by the system, you can link the forefoot corrections to the Zones feature of the footscan software and the associated risk analysis.

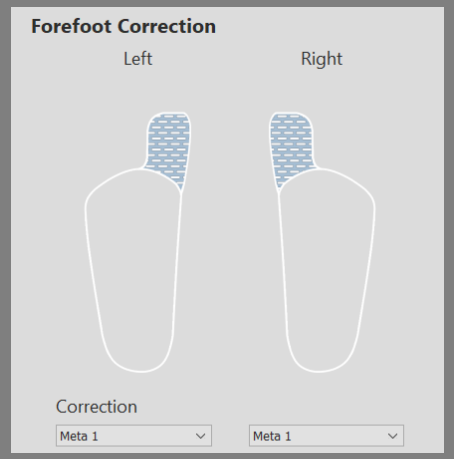
The risk analysis will show you the (in)stability of the propulsion phase by analysing the forces across the metatarsal region from 50% to 80% of the propulsion phase of gait.

In case of a high force on either the medial or lateral side of the forefoot, adding a correction on that side of the forefoot will redistribute the forces over the entire forefoot.
In most cases the flexible forefoot correction will be your choice. However, in more specific cases, i.e. hallux rigidus, a stiff forefoot correction can be a beneficial choice.

You will notice that all forefoot corrections are available in 2 levels of stiffness (Flexible and Stiff) and heights of 2-4mm depending on how much correction is required.

Flexible – To encourage redistribution of pressure and loading.
Stiff – To encourage additional function to specific forefoot regions.

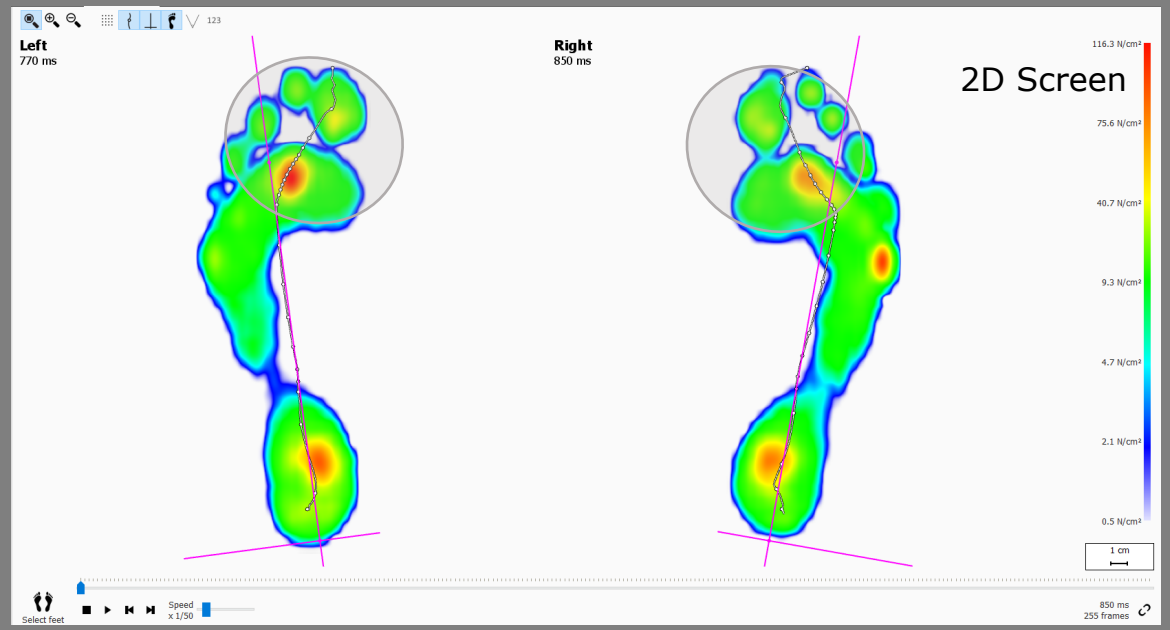
Forefoot Corrections - Meta 1



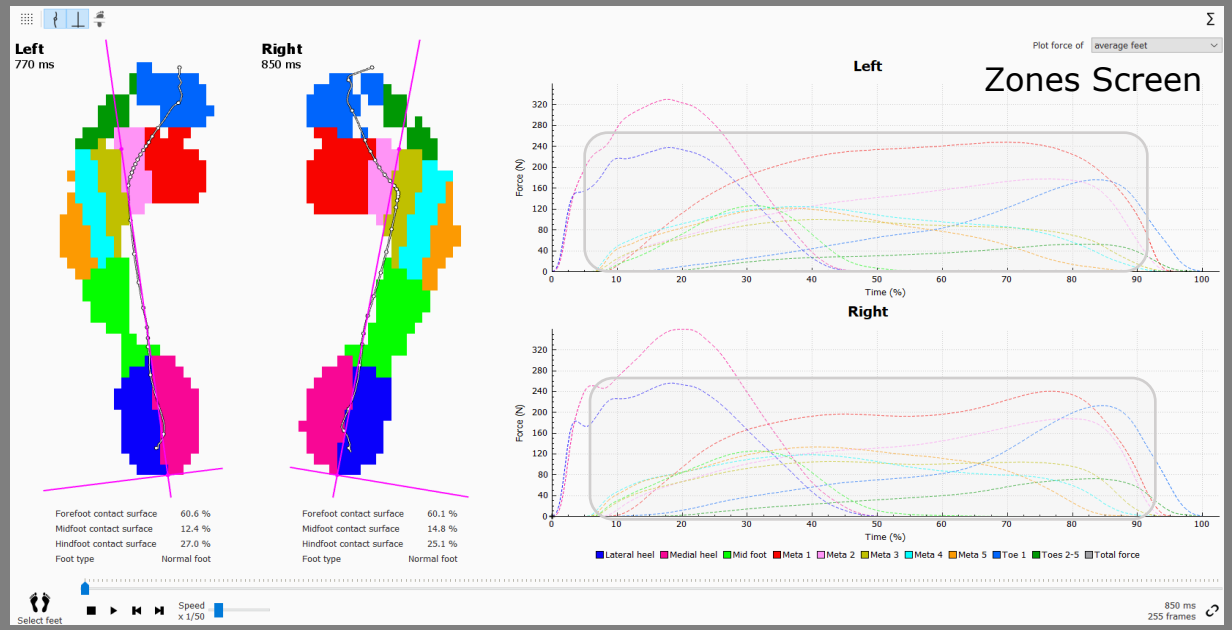
The Meta 1 forefoot correction is the equivalent of Morton's extension.

This is positioned under the 1st metatarsal head and is designed to support 1st MTPJ dorsiflexion at propulsion. It is commonly used either for a restriction in 1st MTPJ range of motion, i.e. hallux limitus, or when the first ray is dorsiflexed. If the ray is dorsiflexed, then applying this modification will avoid the forefoot having to twist to gain 1st met loading. The Meta 1 correction brings the ground up to the dorsiflexed ray and reduces midfoot torsion.

This modification can either be made flexible or stiff depending on the type of control you require.

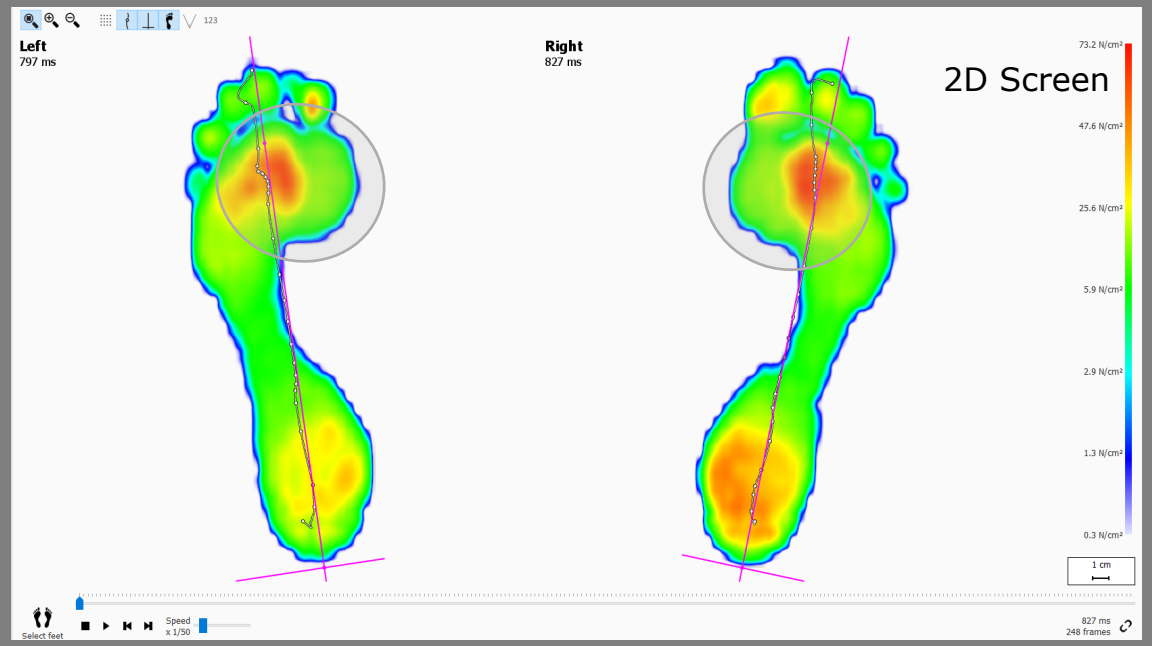


The 2D data above is an example of medial rotation through the 1st metatarsal/toe region. This would benefit from a flexible 2mm Meta 1 correction.

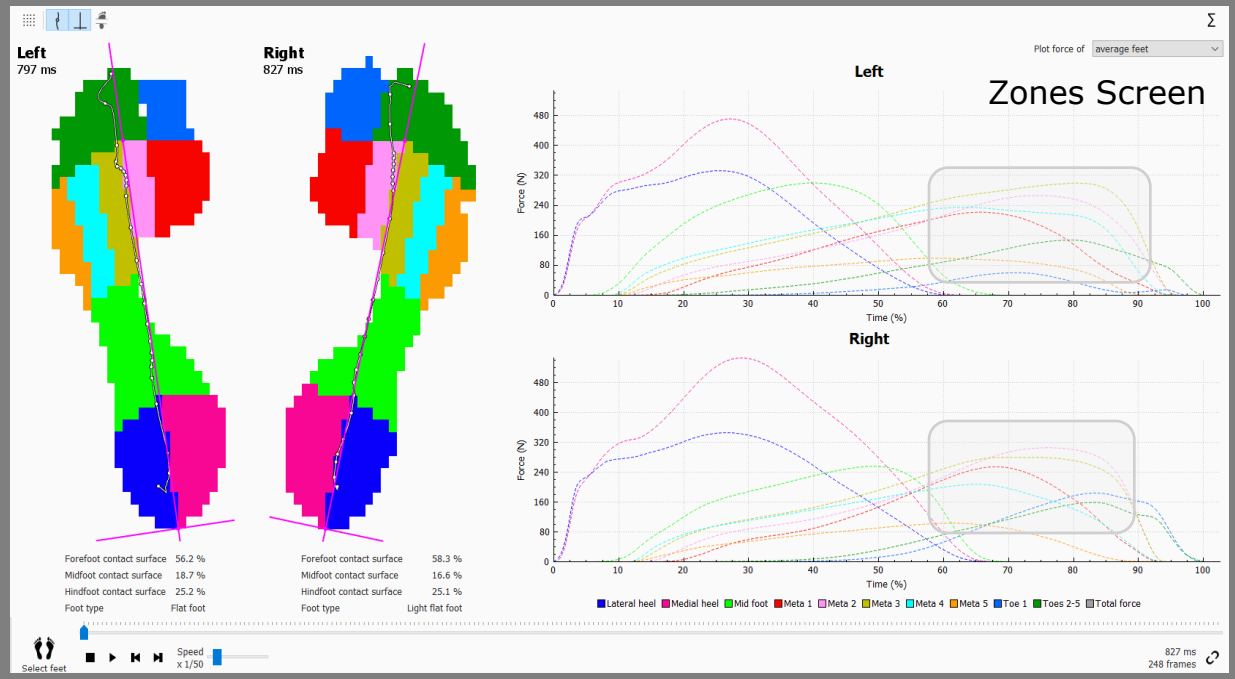


In the Zones above, see how early the 1st met head (red line) makes ground contact and remains in ground contact until toe off. This would benefit from a 2mm flexible Meta 1 correction.

Forefoot Corrections - Meta 1

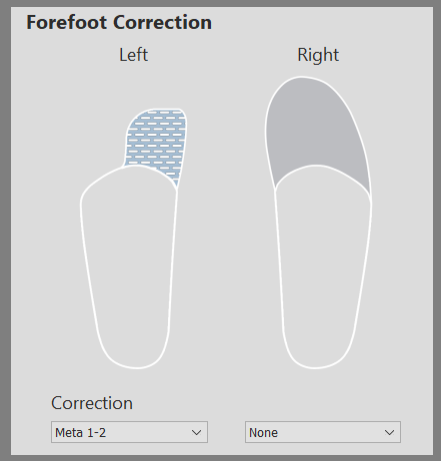


The 2D data to the left is an example of a rigid 1st metatarsal due to Hallux Rigidus. The addition of a 2-3mm stiff Meta 1 forefoot correction can help to improve the function of the 1st metatarsal and reduce pain/discomfort due to the stiffening of the joint.



The Zones data to the right shows a reduced function of the 1st metatarsal due the stiffening of the joint. By applying a stiff Meta 1 correction, this would encourage improved function and loading through this region. Ideally the 1st metatarsal loading (red line) should be above the lines for metatarsals 2-5 prior to propulsion. However as you can see here, the highest propulsive forces are being placed through metatarsals 2-3.

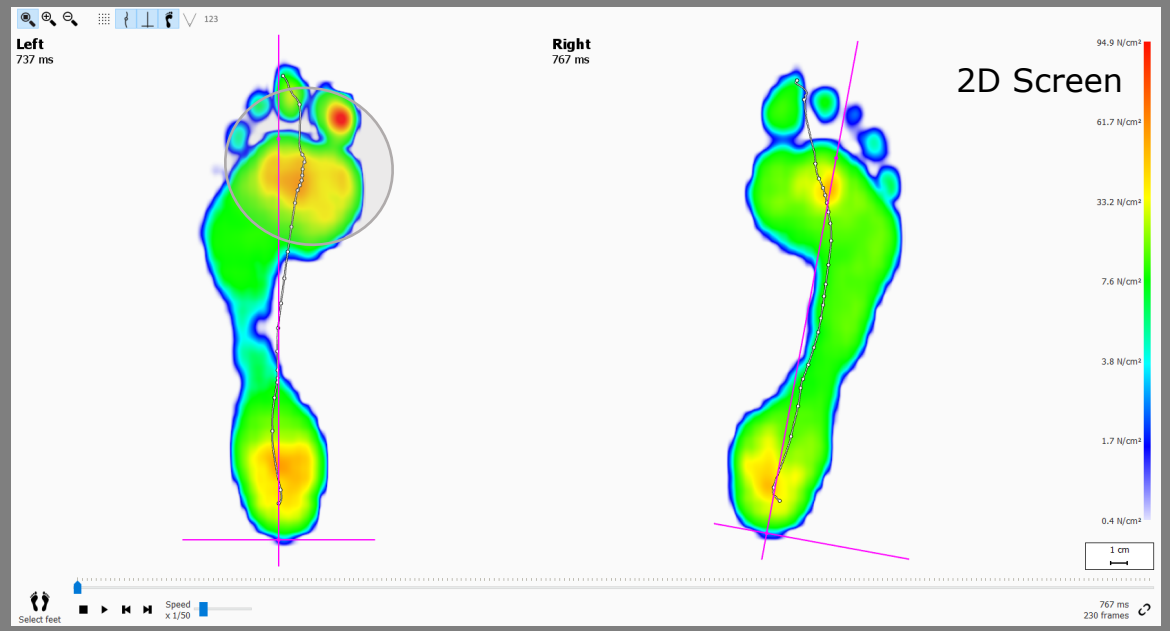
Forefoot Corrections - Meta 1-2



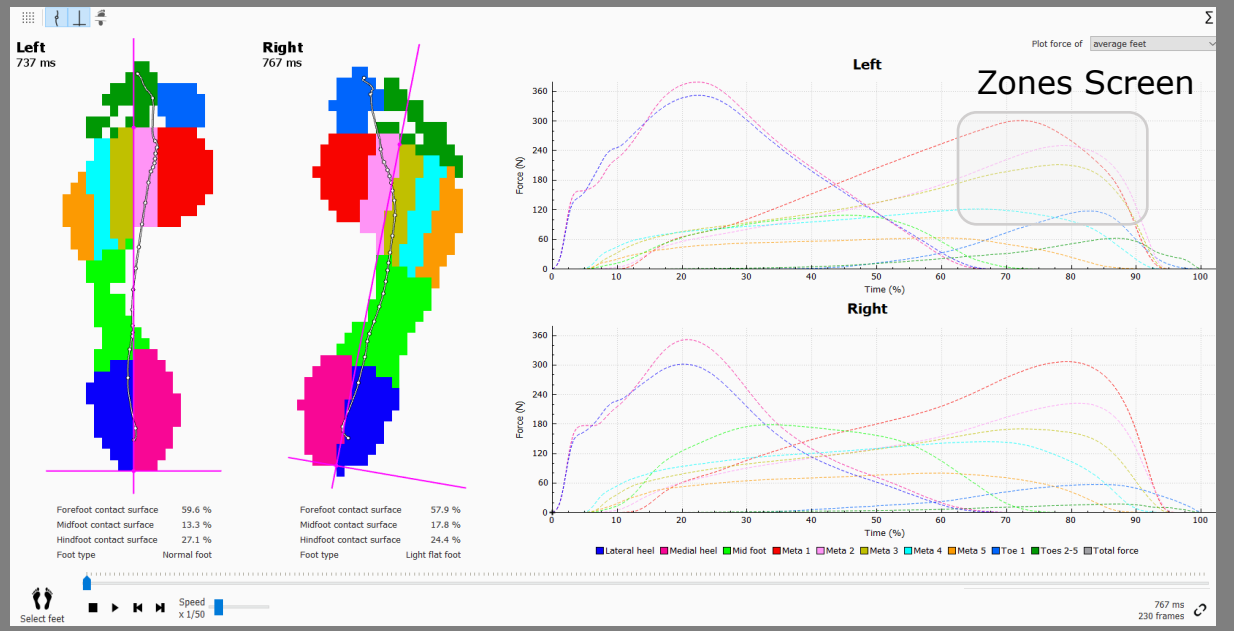
The Meta 1-2 forefoot correction is designed to do the same as the Meta 1 correction, but extending it across the 2nd metatarsal head.

A Meta 1-2 can be beneficial to assist with 1st ray pathologies that promote an abductory twist and overload the 2nd metatarsal head.

This modification can either be made flexible or stiff depending on the type of control you require.

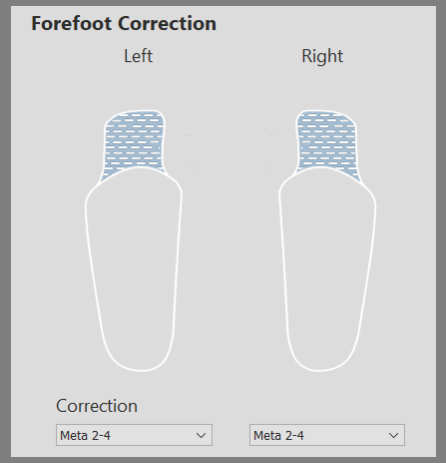


The left foot 2D data above shows increased loading through Metatarsals 1-2. A flexible 2mm Meta 1-2 correction helps to redistribute the pressure improve the propulsive movement.



The left foot Zones data above again highlights the increased forces through Metatarsals 1-2 and quantifies that a Meta 1-2 forefoot correction would be beneficial.

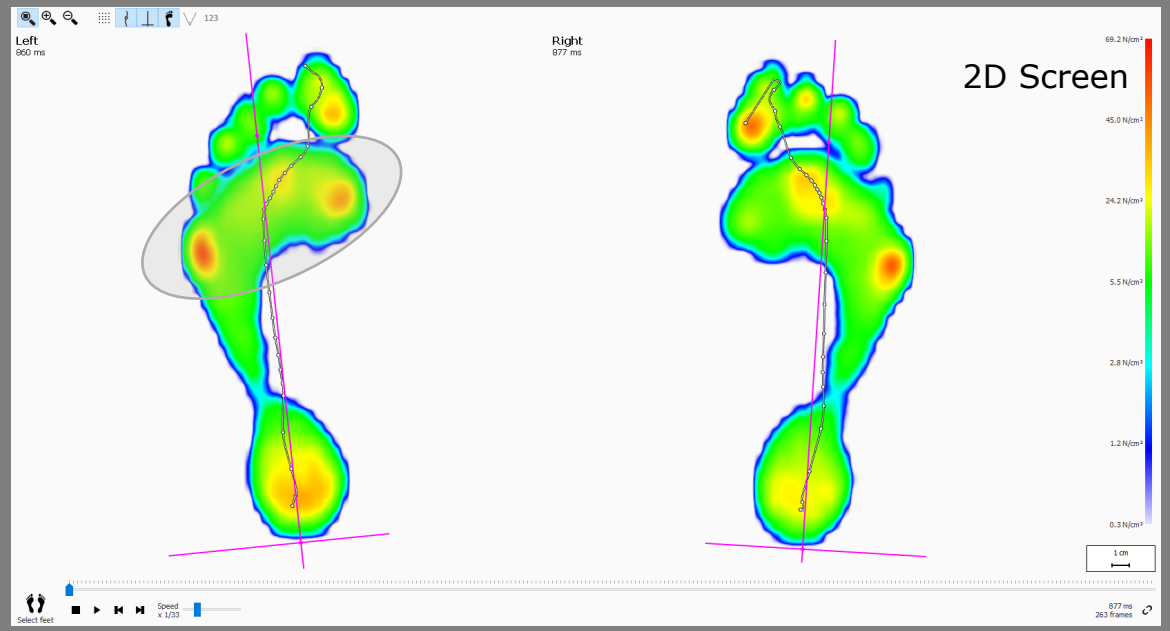
Forefoot Corrections - Meta 2-4



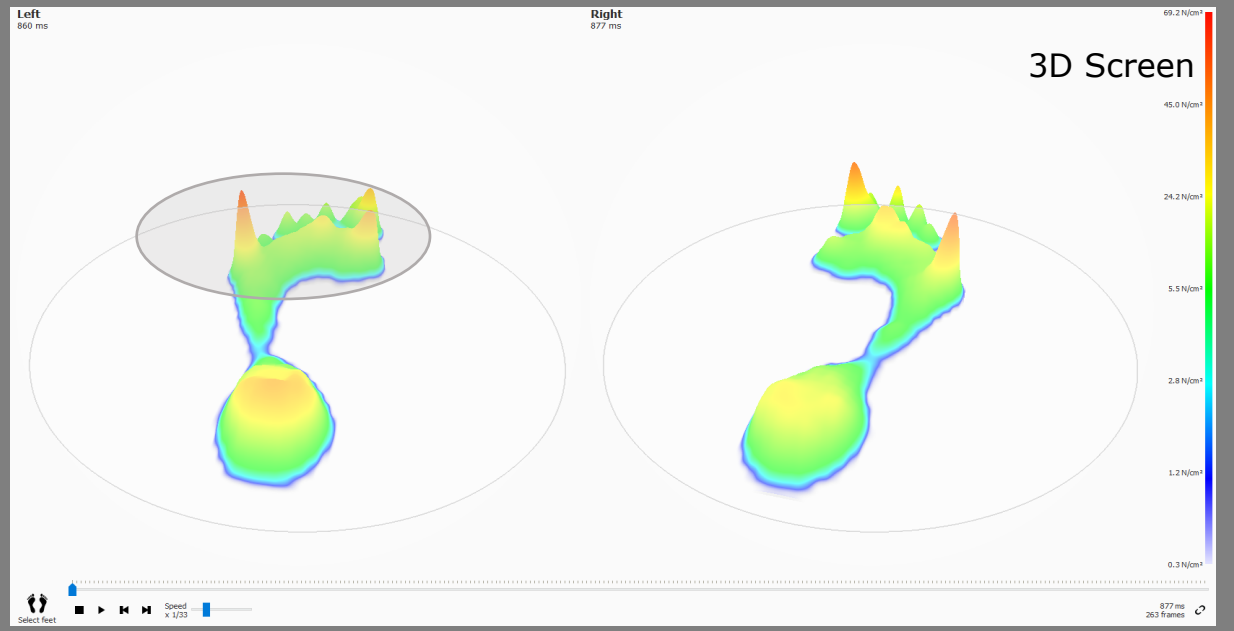
The Meta 2-4 forefoot correction has multiple applications. It acts as a 'lift' to the central 3 metatarsals to either promote or accommodate 1st and 5th metatarsal head loading.

This can be a functional improvement to simply offload painful metatarsal heads. Supinated and pes cavus foot types can present with this load pattern, creating high pressure lesions over the metatarsal heads. Neuroma or neuritis can also be relieved with this modification depending on lesion position. The 1st met cut accommodation can offload painful bunions and the 5th can offload Tailor's bunions.

This modification can either be made flexible or stiff depending on the type of control you require.

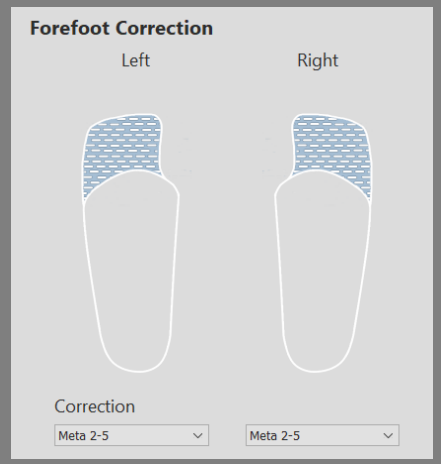


The left foot 2D data above shows increased loading through the 1st and 5th metatarsals. This patient felt pain through both regions, along with callous build up.



The 3D screen above gives a nice visual of these risk areas. The Meta 2-4 correction allows for the 1st and 5th to be accommodated, encouraging better function of metatarsals 2-4.

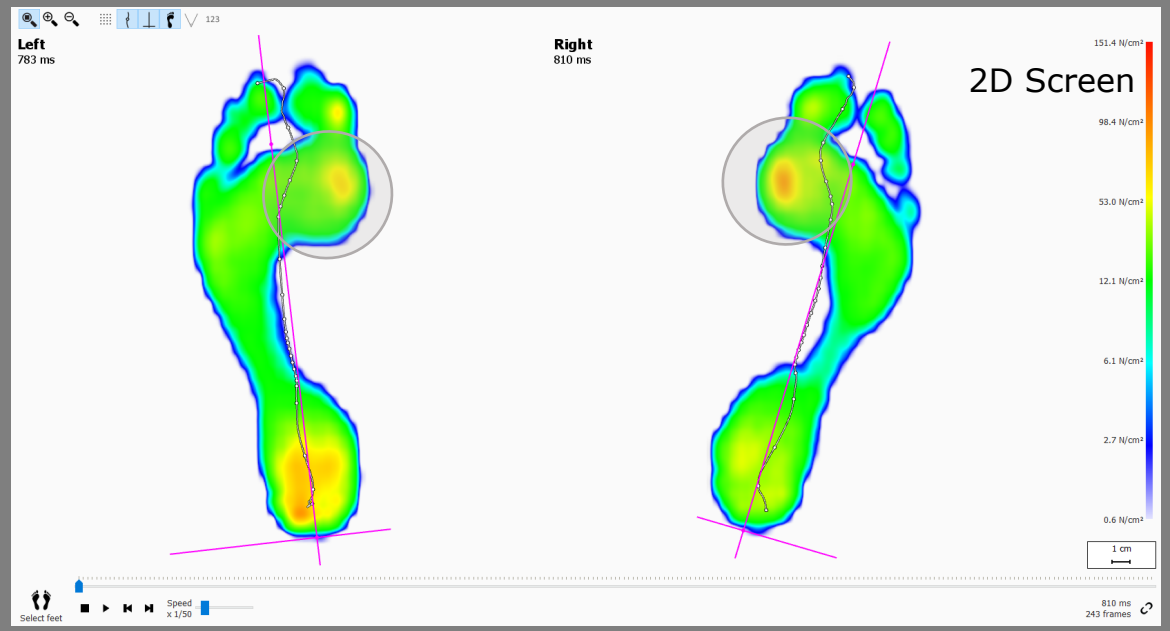
Forefoot Corrections - Meta 2-5



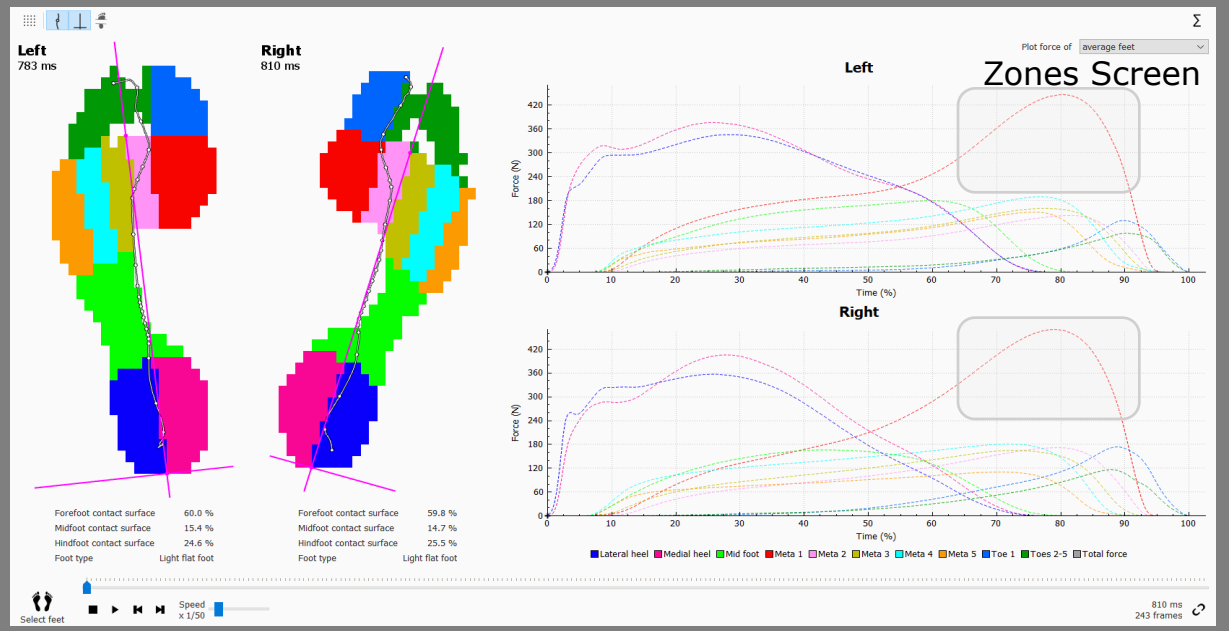
The Meta 2-5 forefoot correction acts primarily to offload the 1st metatarsal head, but this can have the additional benefit of acting as a functional modification by allowing the 1st ray to plantar flex and reduce fascial tension.

This correction re-establishes 1st MTPJ dorsiflexion and reduces the effect of a functional hallux limitus. Both pronated and supinated feet can benefit from a Meta 2-5.

This modification can either be made flexible or stiff depending on the type of control you require.

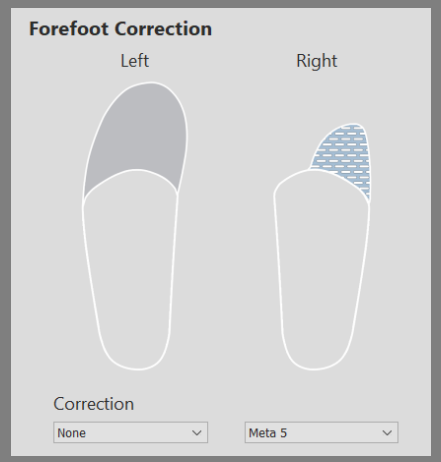


In this instance, the Meta 2-5 correction (flexible 2mm) was used to accommodate the 1st metatarsal due to increased loading and callous build up.



In the Zones screen above, there is excessive force through the 1st metatarsal, causing discomfort. A Meta 2-5 allows for the 1st to be accommodated to offload and reduce the forces.

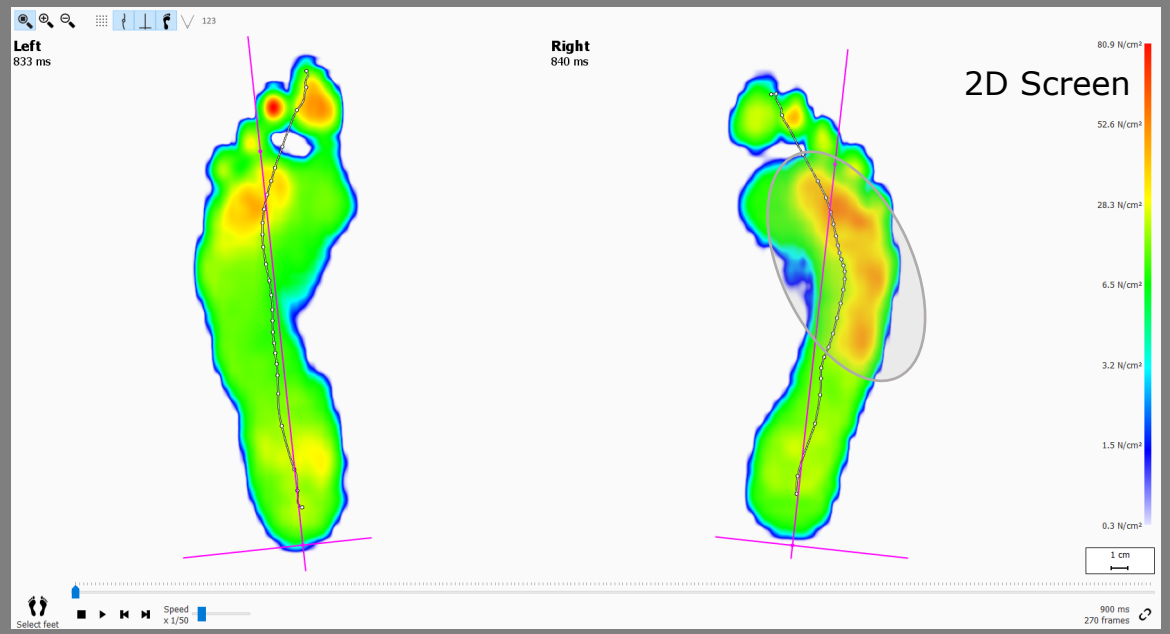
Forefoot Corrections - Meta 5



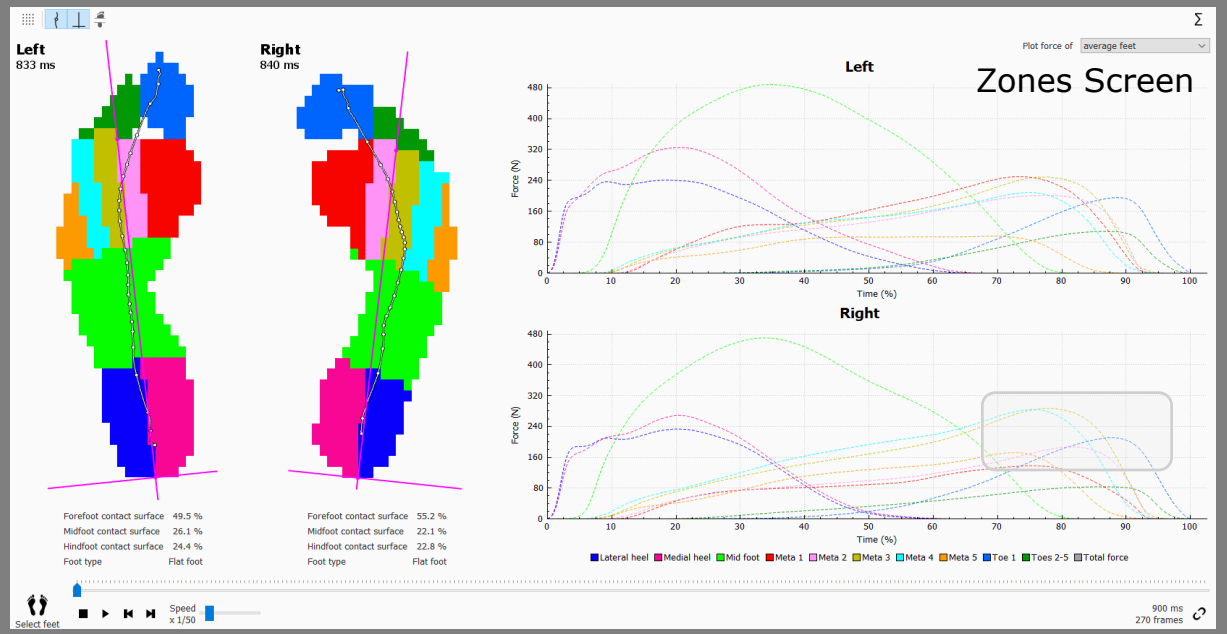
The Meta 5 forefoot correction has a few functions; including lateral forefoot posting, accommodating a dorsiflexed 5th ray and influencing the function of the peroneal compartment.

It is used effectively with a supinated foot posture to promote 1st metatarsal loading and promote midfoot rotation. This modification can also reduce the effect of the peroneal compartment in overuse issues by altering the course of the tendon to reduce its function.

This modification can either be made flexible or stiff depending on the type of control you require.



The right foot 2D data above highlights overloading of metatarsals 4-5. A Meta 5 encourages a better pronatory roll off at propulsion, reducing forces under the lateral forefoot.



The Zones data above shows the additional force being placed through metatarsals 4-5. This force would be redistributed and offloaded by applying the Meta 5 correction.

Phits Design Clinical Guide

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