Rapid Snail Racing || Bike

General Fit Session | September 3, 2015
Robert Welsford

Aug 25, 2025

Rapid Snail Racing
L1V3G4
Pickering, On

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BFF PRO

OVERVIEW

Session

Date: Aug 25, 2025 at 09:58
Objective: General Fitting

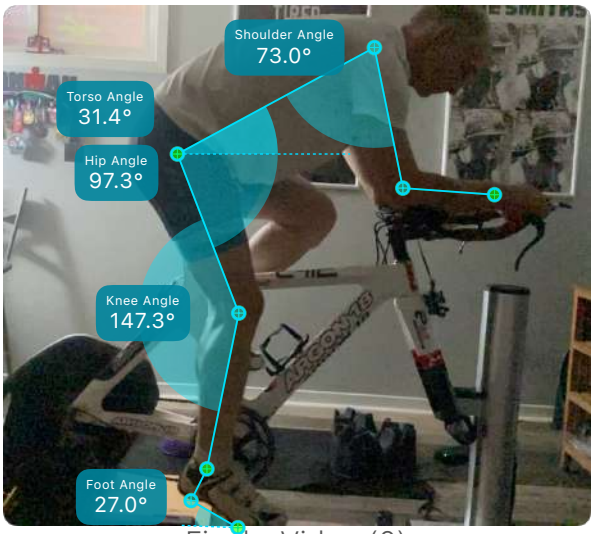
Rider

Name: Robert Welsford
Experience Level: Advanced

Bike

Bike Make/Model: Aero Bike
Bike Type: Aero/TT

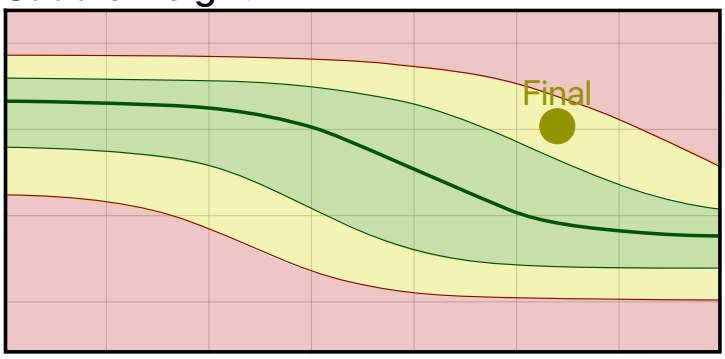
Bottom of Pedal Stroke



Final - Video (0)

This is where the knee is at it's maximum extension and is the main factor in setting the saddle height. Getting this right is the foundation for a good bike fit, efficient power transfer and minimizing the risk of injury.

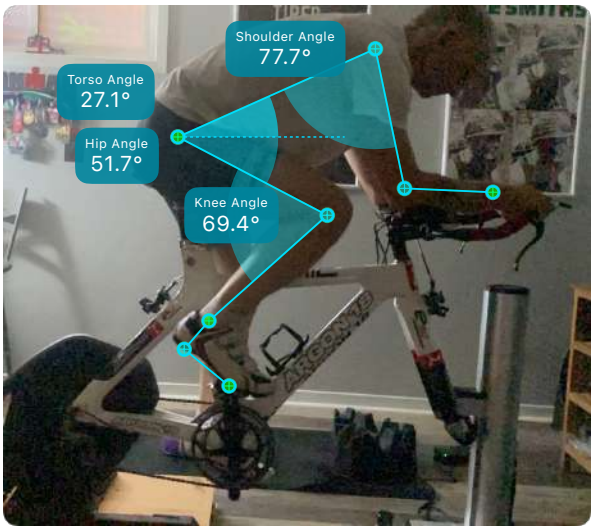
Saddle Height



Knee Angle

	Final
Knee Angle	147.3°
Hip Angle	97.3°
Foot Angle	27.0°
Shoulder Angle	73.0°
Torso Angle	31.4°

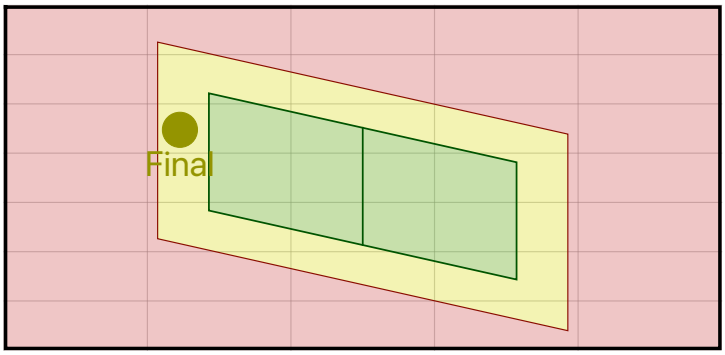
Top of Pedal Stroke



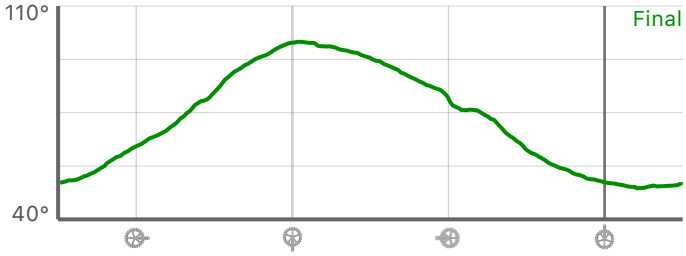
Final - Video (0)

This is the portion of the pedal stroke with the minimum knee angle and hip angles. It is the main factor in considering changes to shorter cranks.

Rider Position

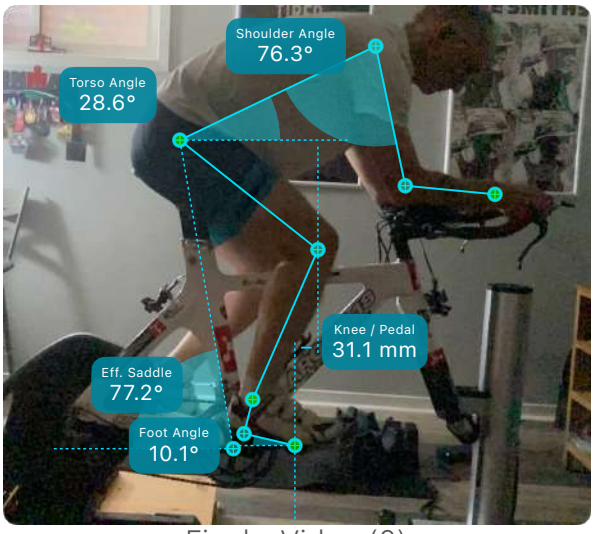


Hip Angle



	Final
Knee Angle	69.4°
Hip Angle	51.7°
Shoulder Angle	77.7°
Torso Angle	27.1°

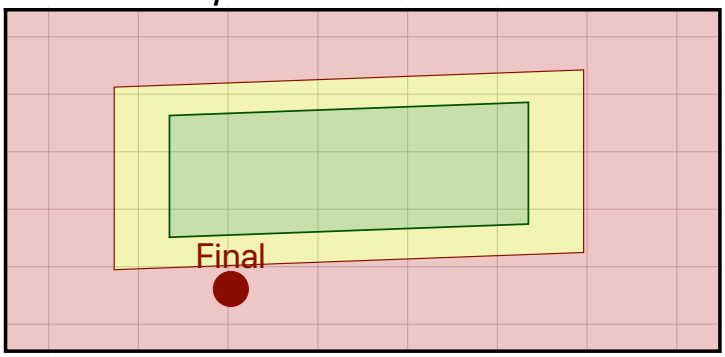
Front of Pedal Stroke



Final - Video (0)

This is the power portion of the pedal stroke and is important for ensuring the fore/aft positioning is correct.

Saddle Fore/Aft

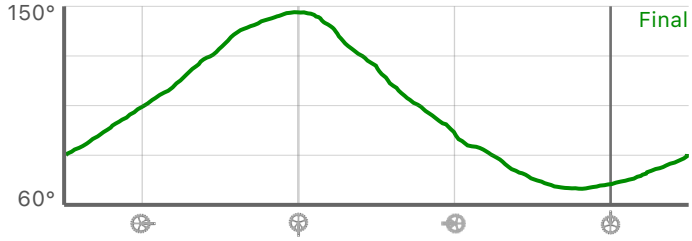


	Final
Knee / Pedal	31.1 mm
Effective Saddle Angle	77.2°
Foot Angle	10.1°
Shoulder Angle	76.3°
Torso Angle	28.6°

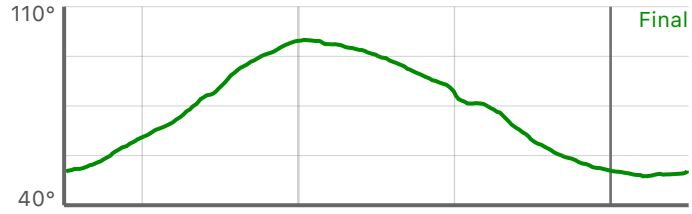
Comparison Graphs

Final - Video (0)

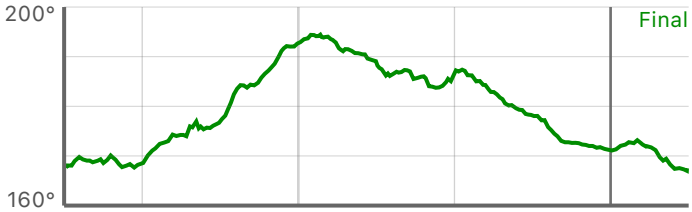
Knee Angle



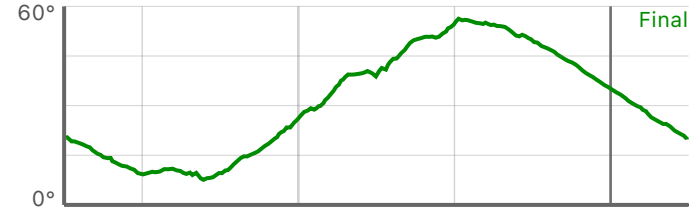
Hip Angle



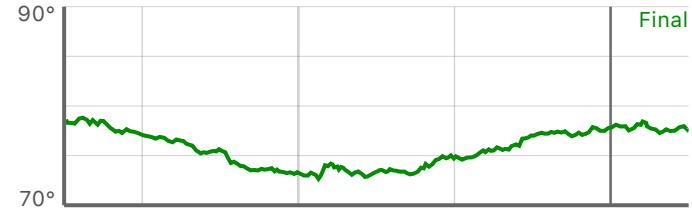
Ankle Angle



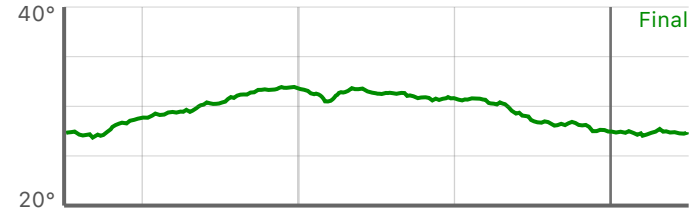
Foot Angle



Shoulder Angle



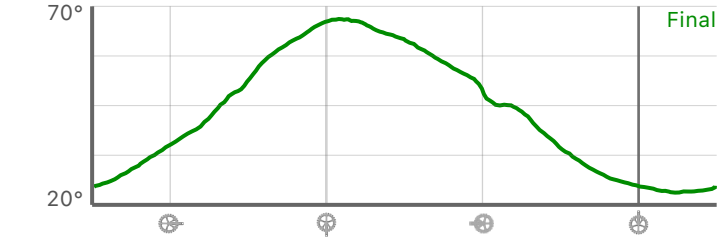
Torso Angle



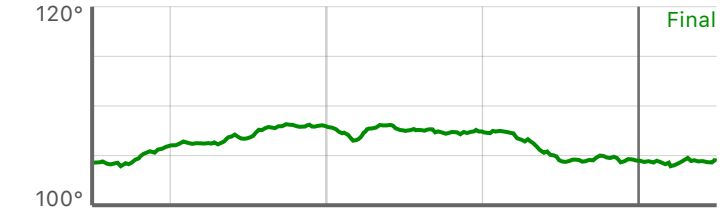
Comparison Graphs
(continued)

Final - Video (0)

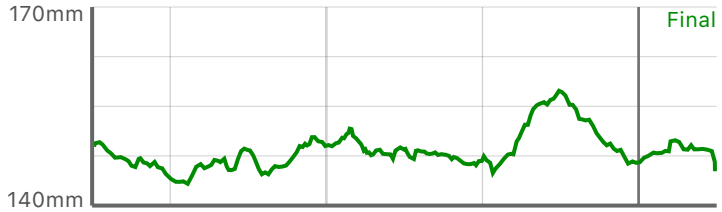
Knee Hip Horizontal



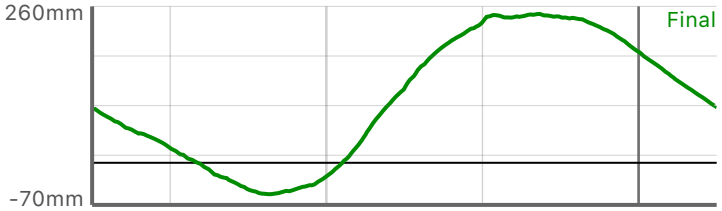
Hip BB Angle



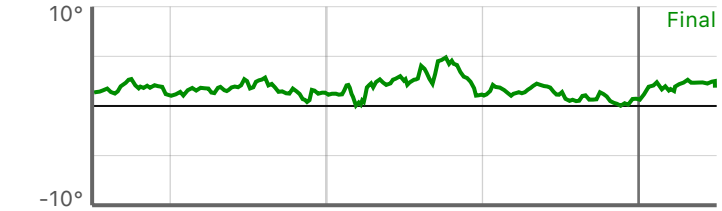
Hip Fore/Aft



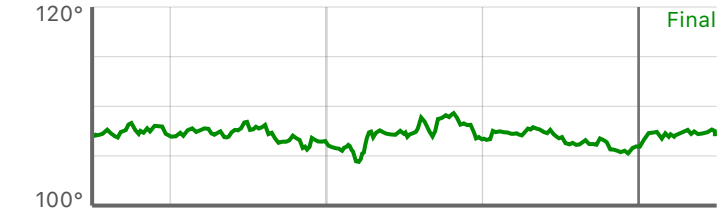
Knee / Pedal



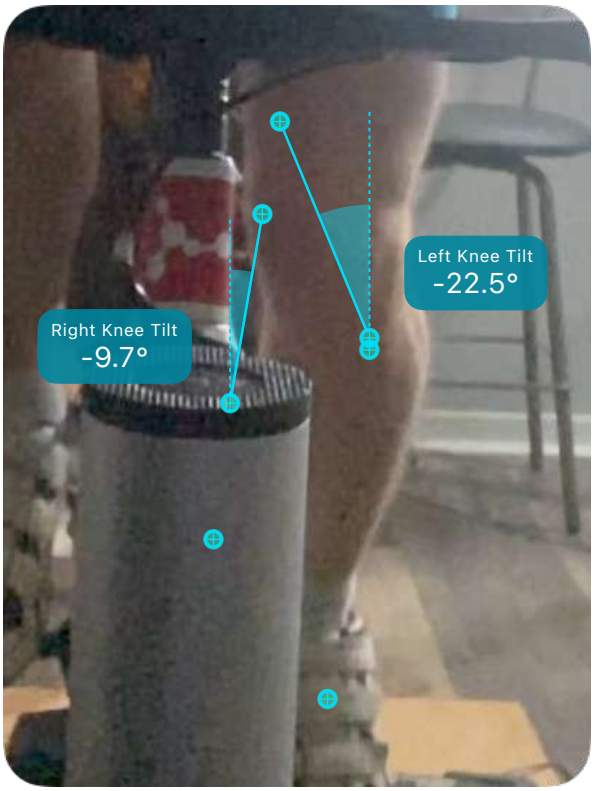
Forearm Angle



Elbow Angle



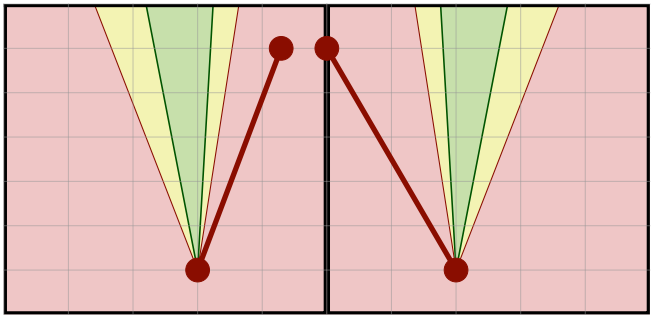
Knee Tilt



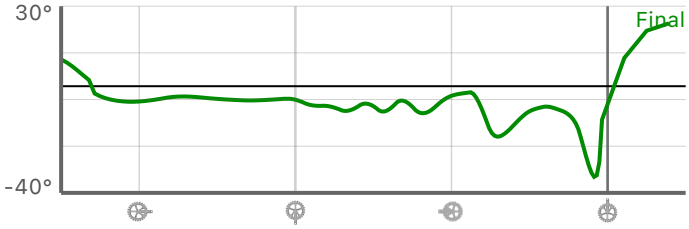
Final - Video (1)

Excessive knee tilt can lead to repetive motion injuries and reduce pedaling efficiency and power transfer.

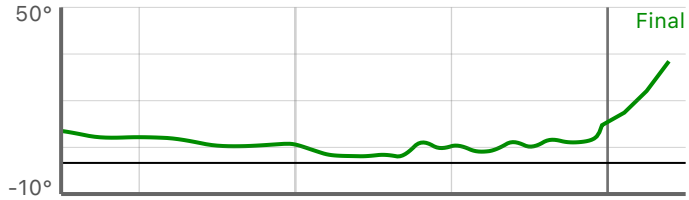
Final - Knees In



Right Knee Angle

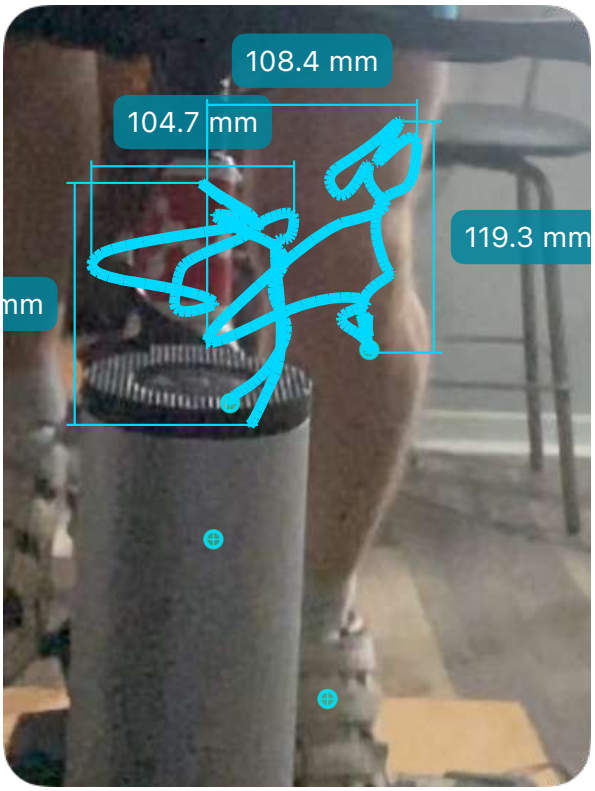


Left Knee Angle



	Final
Right Knee Tilt	-9.7°
Left Knee Tilt	-22.5°

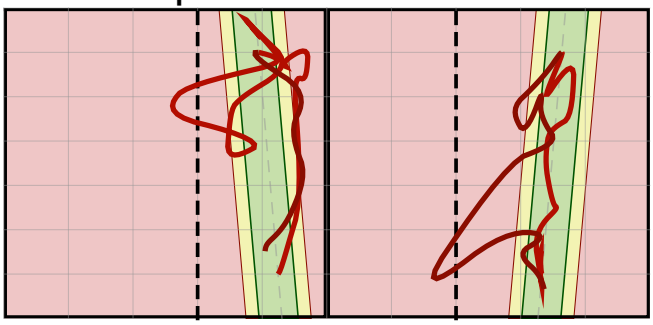
Knee Tracking



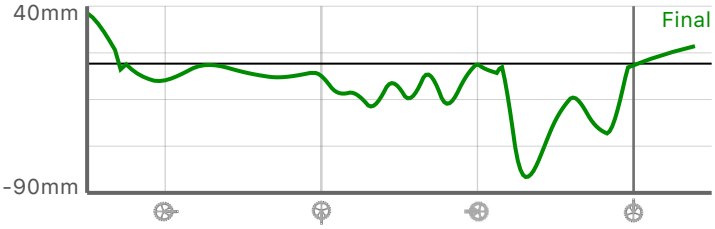
Final - Video (1)

Excessive movement of the knee during a pedal stroke can increase the possibility of injury and knee pain.

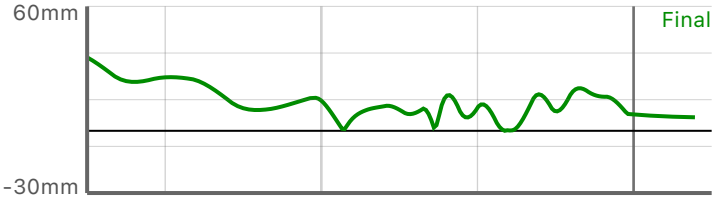
Final - Elliptical



Right Knee Displacement

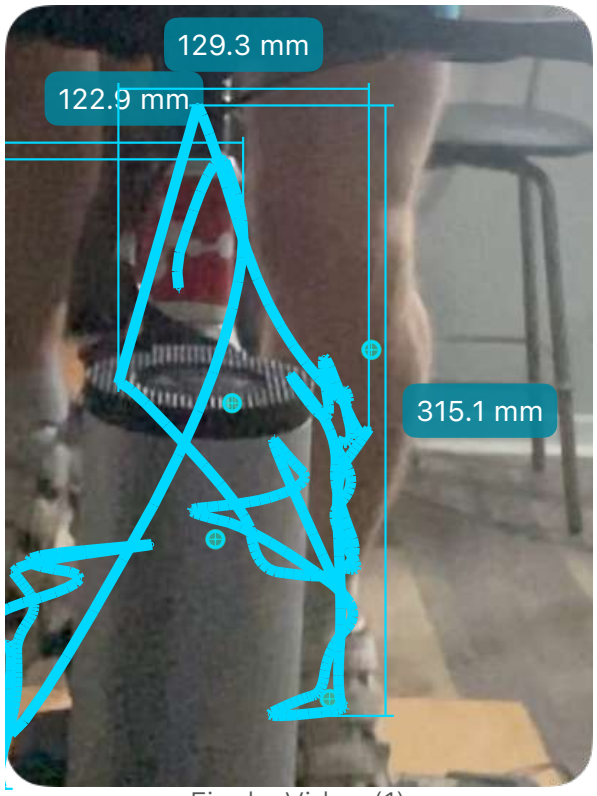


Left Knee Displacement



	Final
Right Knee Trace	↔ 104.7 mm ↕ 124.9 mm
Left Knee Trace	↔ 0.0 mm ↕ 0.0 mm

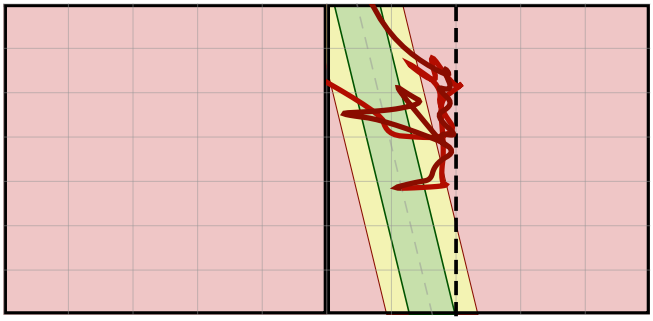
Toe Tracking



Final - Video (1)

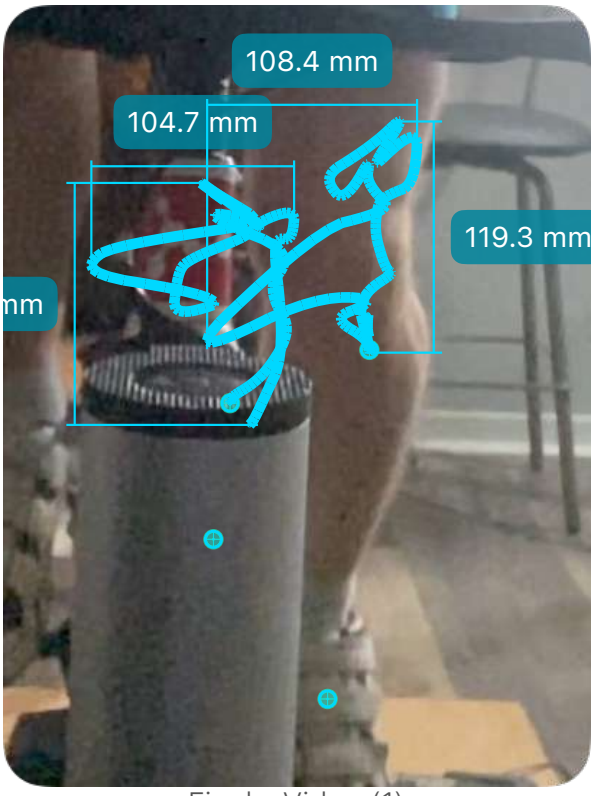
The quality of the track of the toe during the pedal stroke is used to determine the quality of the knee track analysis.

Final - Poor



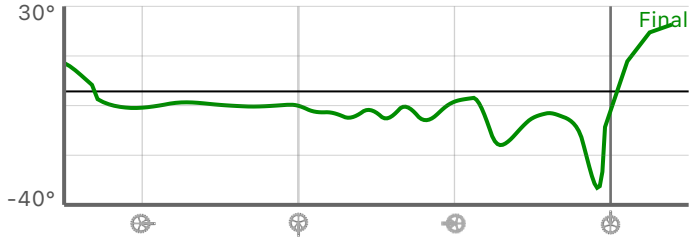
	Final
Right Toe Trace	↔ 143.7 mm ↕ 324.9 mm
Left Toe Trace	↔ 0.0 mm ↕ 0.0 mm

Comparison Graphs

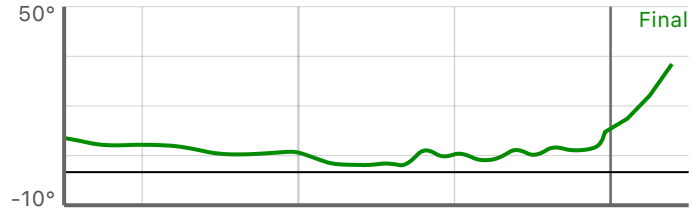


Final - Video (1)

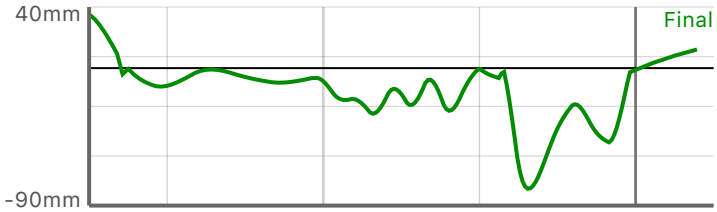
Right Knee Angle



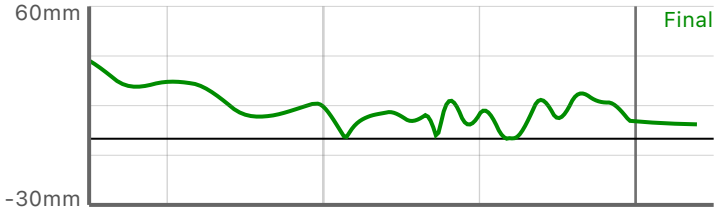
Left Knee Angle



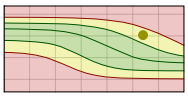
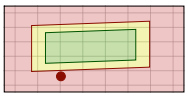
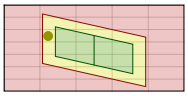
Right Knee Displacement



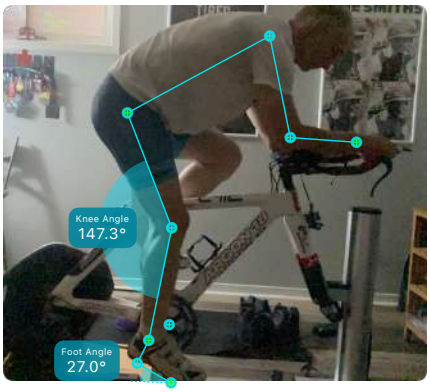
Left Knee Displacement

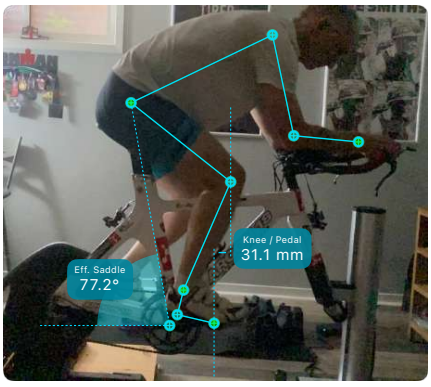


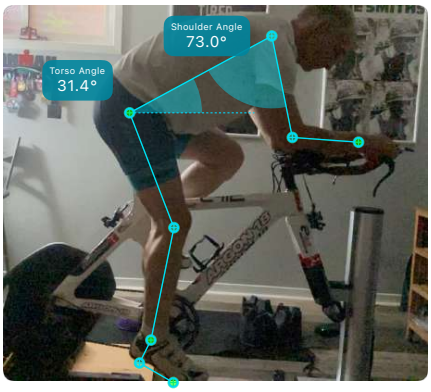
Side Recordings

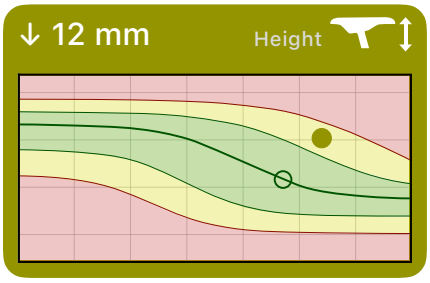
	Video (0) Sep 3, 2025 15:13
	
Saddle Height	
Knee Angle — Min	69.4°
Knee Angle — Max	147.3°
Hip Angle — Closed	51.7°
Hip Angle — Open	97.3°
Saddle Fore/Aft	
Knee / Pedal	31.1 mm
Effective Saddle Angle	77.2°
Foot Angle	10.1°
Rider Position	
Shoulder Angle	77.7°
Shoulder Angle	73.0°
Torso Angle	27.1°
Torso Angle	31.4°

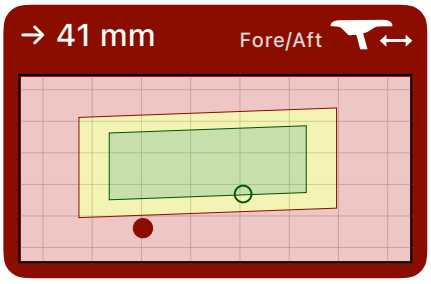
Video (0)

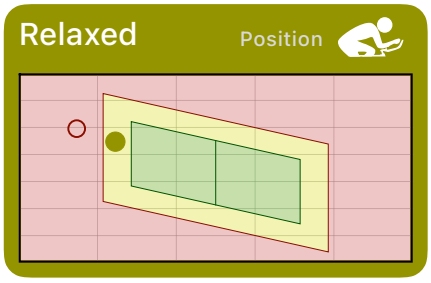












Saddle Height

Knee Angle	147.3°
Foot Angle	27.0°

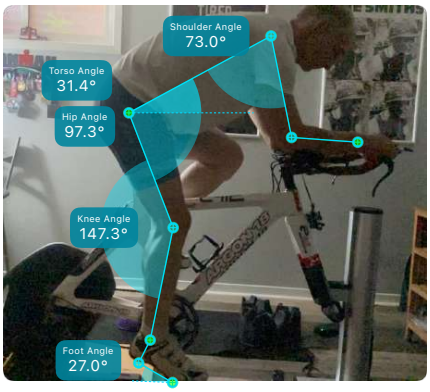
Saddle Fore/Aft

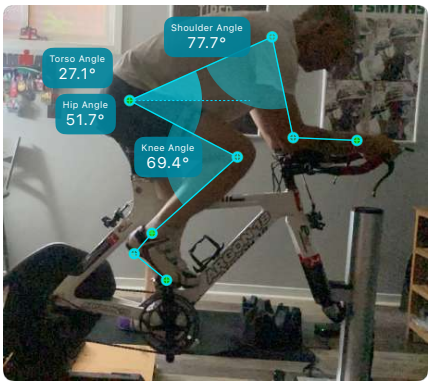
Effective Saddle Angle	77.2°
Knee / Pedal	31.1 mm

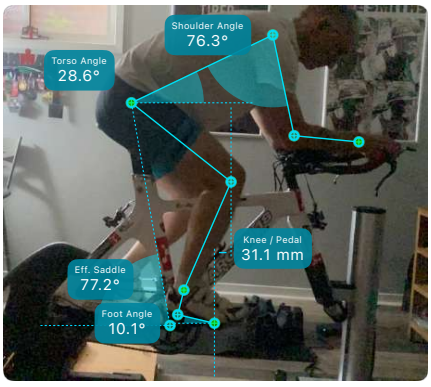
Rider Position

Torso Angle	31.4°
Shoulder Angle	73.0°

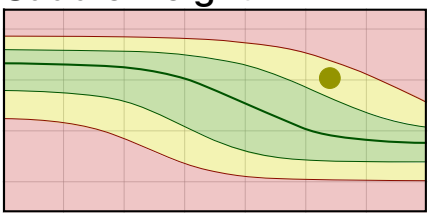
Video (0)
(continued)



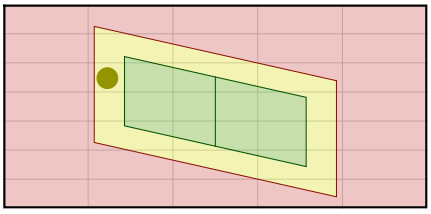




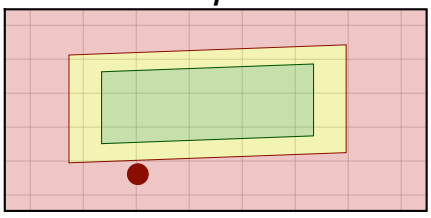
Saddle Height



Rider Position



Saddle Fore/Aft



Bottom of Pedal Stroke

Knee Angle	147.3°
Hip Angle	97.3°
Foot Angle	27.0°
Shoulder Angle	73.0°
Torso Angle	31.4°

Top of Pedal Stroke

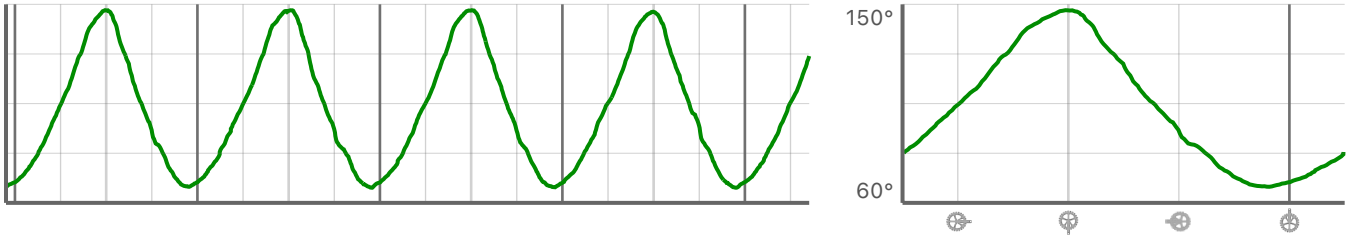
Knee Angle	69.4°
Hip Angle	51.7°
Shoulder Angle	77.7°
Torso Angle	27.1°

Front of Pedal Stroke

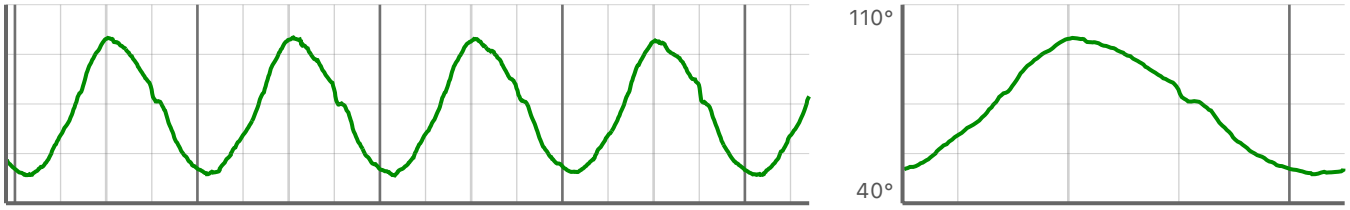
Knee / Pedal	31.1 mm
Effective Saddle Angle	77.2°
Foot Angle	10.1°
Shoulder Angle	76.3°
Torso Angle	28.6°

Video (0)
(continued)

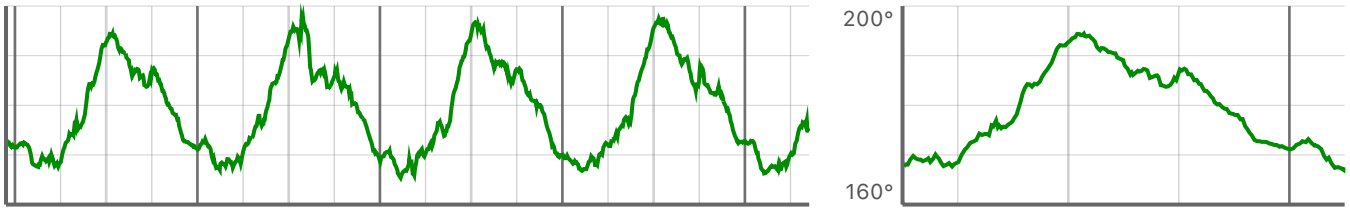
Knee Angle



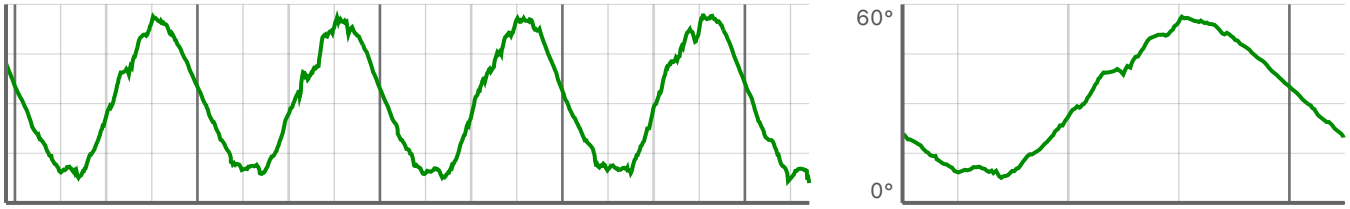
Hip Angle



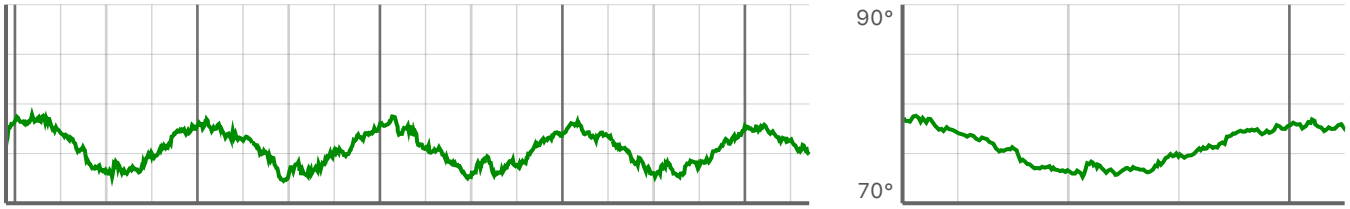
Ankle Angle



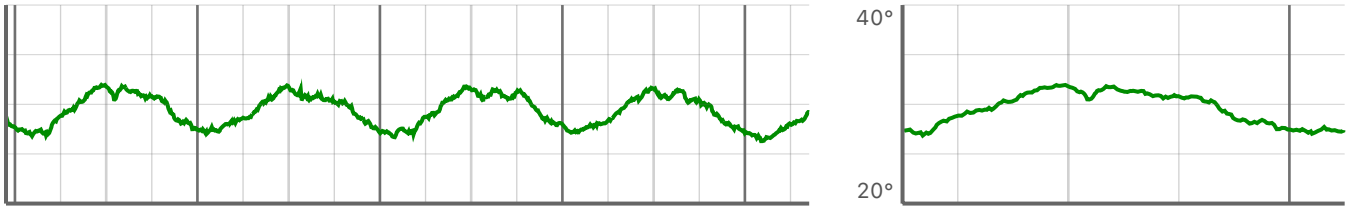
Foot Angle



Shoulder Angle

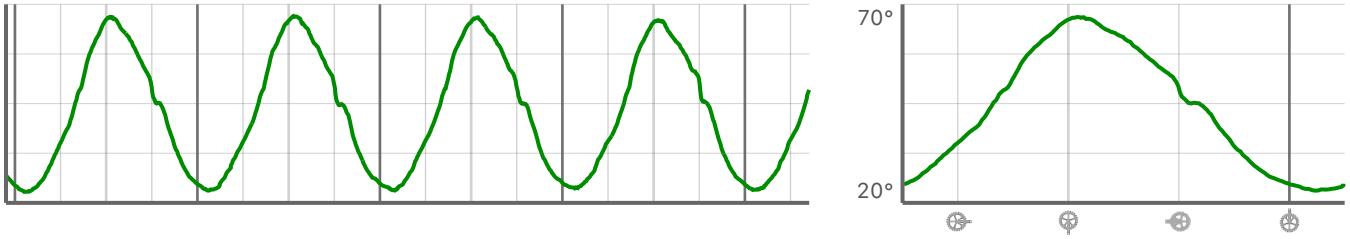


Torso Angle

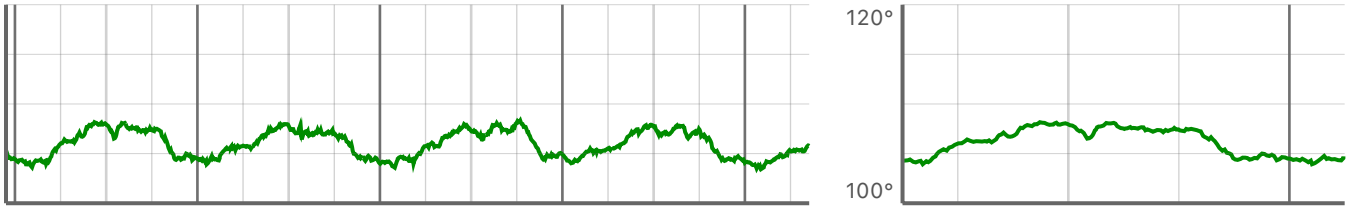


Video (0)
(continued)

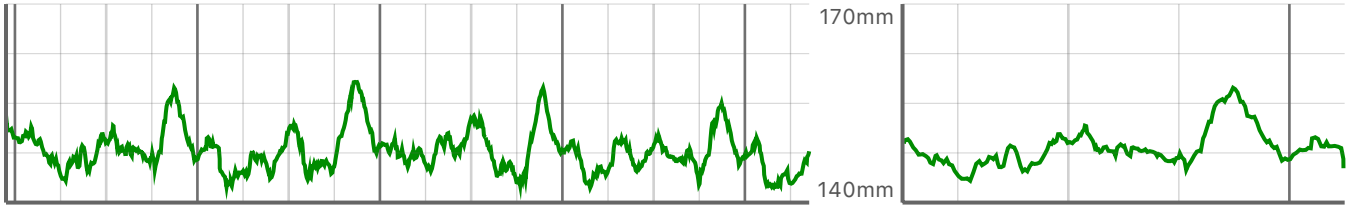
Knee Hip Horizontal



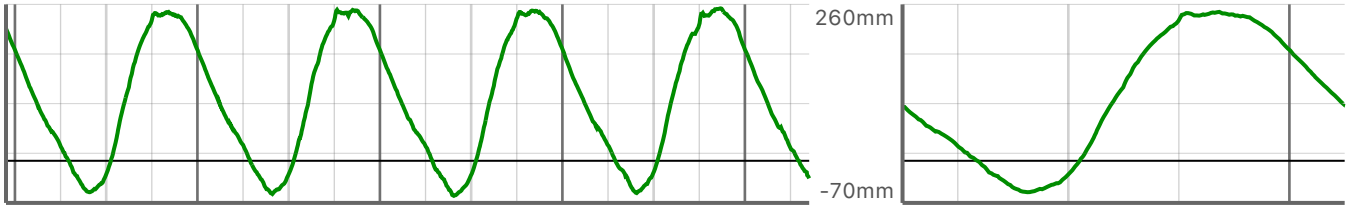
Hip BB Angle



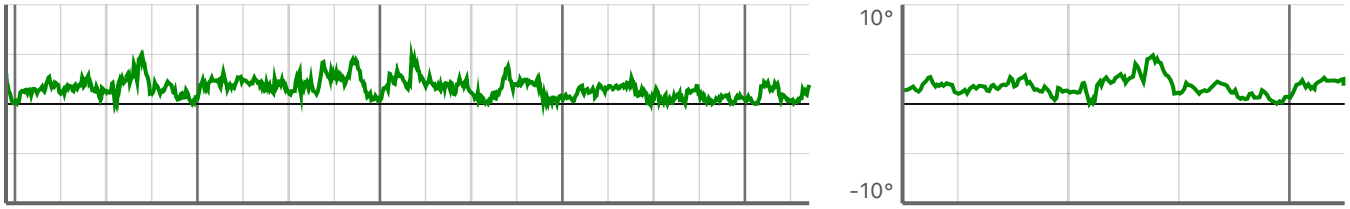
Hip Fore/Aft



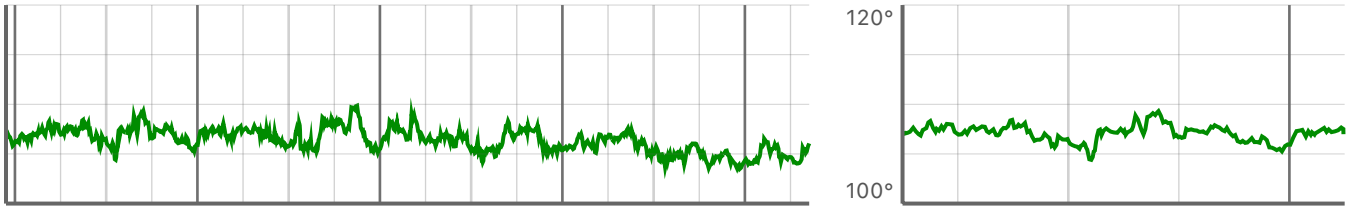
Knee / Pedal



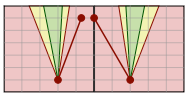
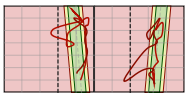
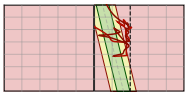
Forearm Angle



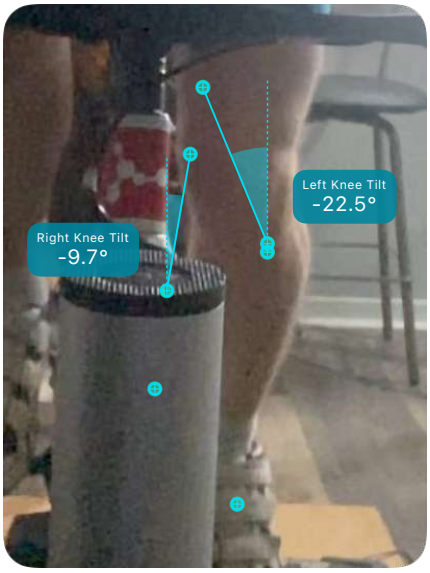
Elbow Angle

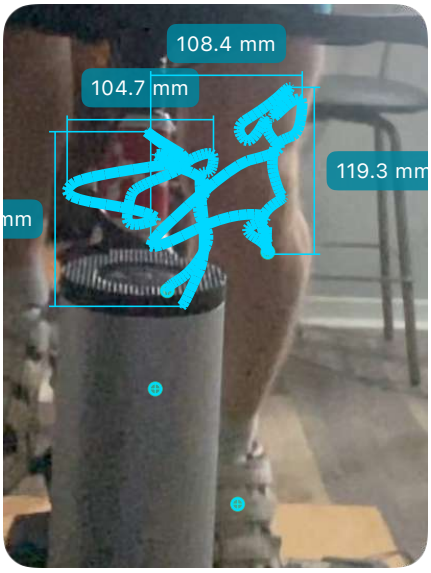


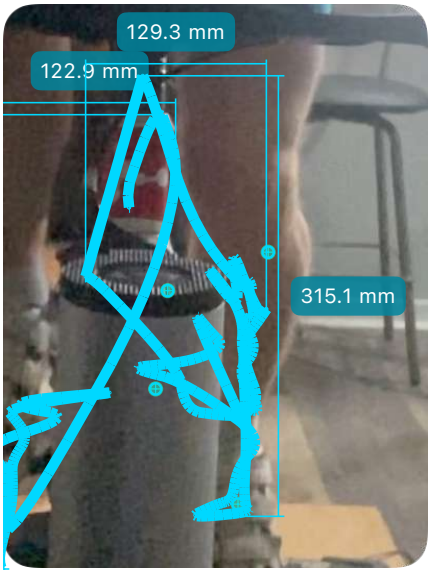
Front Recordings

	Video (1) Sep 3, 2025 15:47
	
Knee Tilt	
Classification	Knees In
Right Knee Angle	-9.7°
Left Knee Angle	-22.5°
Knee Tracking	
Classification	Elliptical
Right Knee Trace	↔ 104.7 mm ↕ 124.9 mm
Left Knee Trace	↔ 108.4 mm ↕ 119.3 mm
Toe Tracking	
Right Toe Trace	↔ 143.7 mm ↕ 324.9 mm
Left Toe Trace	↔ 129.3 mm ↕ 315.1 mm

Video (1)







Right Knee Tilt

Right Knee Tilt	-9.7°
Left Knee Tilt	-22.5°

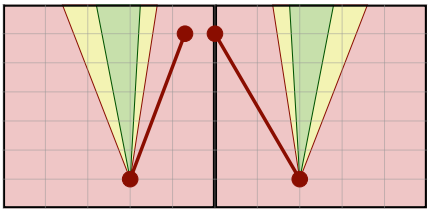
Knee Tracking

Right Knee Trace	↔ 104.7 mm ↕ 124.9 mm
Left Knee Trace	↔ 108.4 mm ↕ 119.3 mm

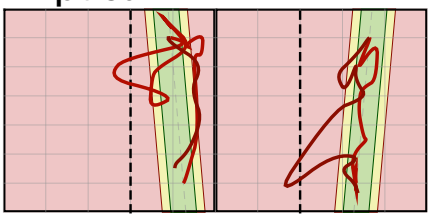
Toe Tracking

Right Toe Trace	↔ 143.7 mm ↕ 324.9 mm
Left Toe Trace	↔ 129.3 mm ↕ 315.1 mm

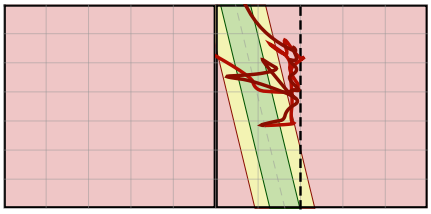
Knees In



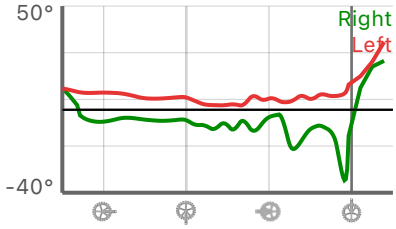
Elliptical



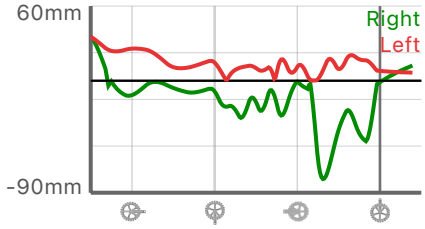
Poor



Knee Tilt

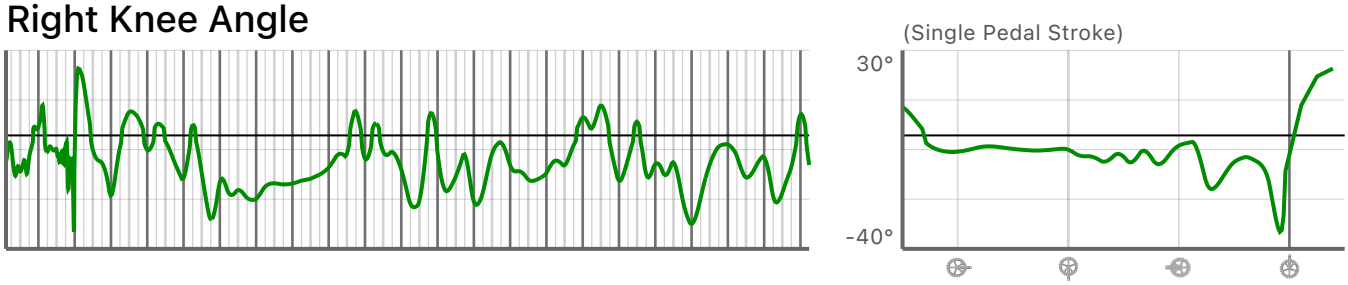


Knee Displacement

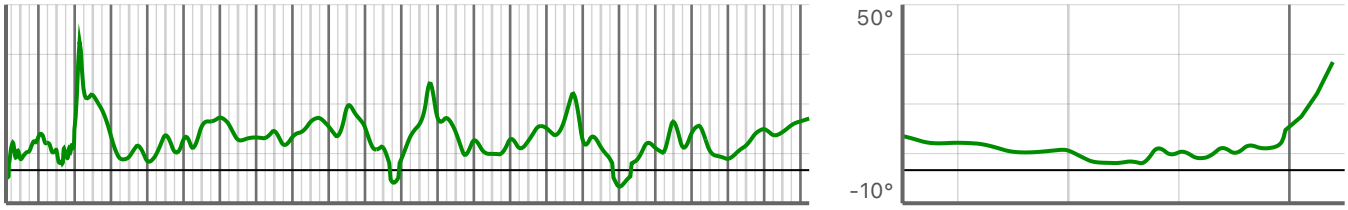


Video (1)
(continued)

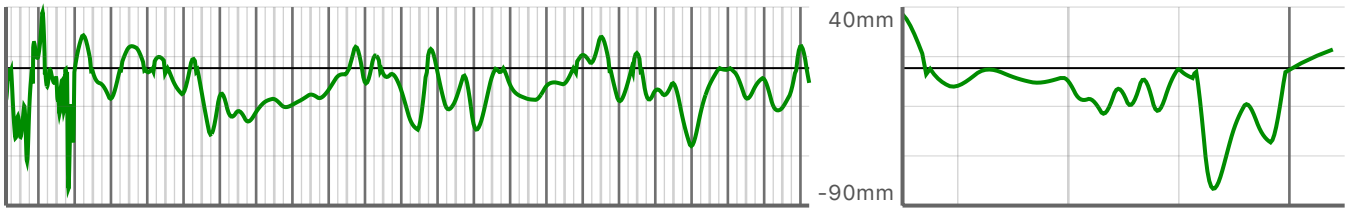
Right Knee Angle



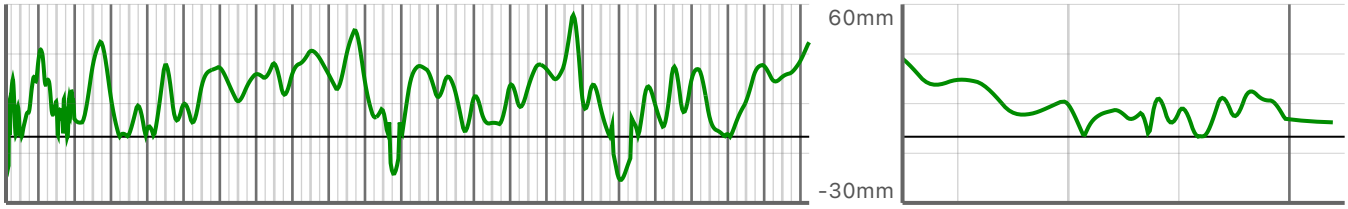
Left Knee Angle



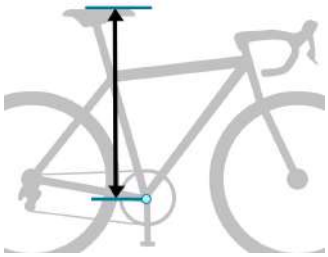
Right Knee Displacement



Left Knee Displacement



Saddle Height



Description
A recommended change to the saddle height based the rider's knee angle and foot angle at the point of maximum knee extension (MKE).

Why to Consider
Having your saddle set to the right height is the first and most important step in setting up your bike. If your saddle is too low, your legs are not working efficiently. On the other hand, if your saddle is too high, you risk injury from overextending your knees.

What is Important
This is one of the most critical measurements for a proper and efficient bicycle fit for several reasons:

Power Transfer and Efficiency
When your saddle height is set correctly, you can fully extend your leg during the pedal stroke without overextending, which allows for optimal power transfer and efficient pedaling.

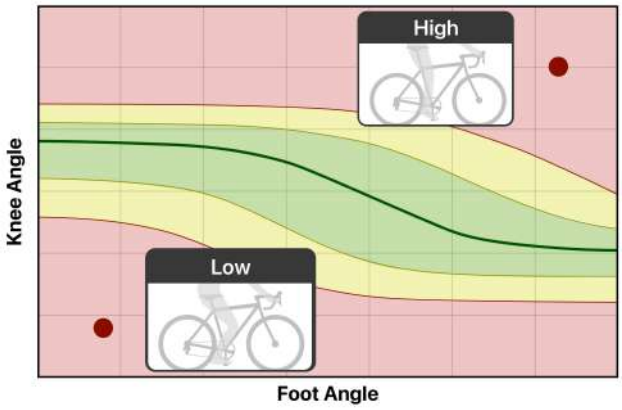
Injury Prevention
An incorrect saddle height can lead to injuries. If the saddle is too high, you might overextend your knee or have to rock your hips to reach the pedal at the bottom of the stroke, which can cause back and knee problems. If the saddle is too low, it can cause you to flex your knee excessively, putting undue pressure on the kneecap.

Comfort
Correct saddle height contributes to overall comfort on the bike. If your saddle is too high or too low, it can lead to discomfort and muscle imbalances. Proper saddle height allows for comfortable, sustained pedaling.

Muscle Engagement
Proper saddle height also helps ensure the right muscles are being engaged during the pedal stroke. Too low, and you're primarily using your quadriceps and risking knee injury. Too high, and you might be over-engaging your hamstrings and calf muscles, which could lead to muscle strain.

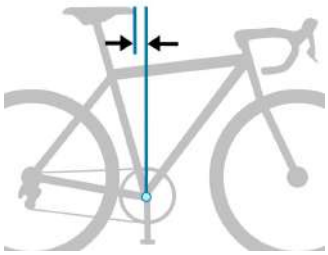
How to Interpret
The algorithm determines your optimal saddle height based on the knee and foot angle. Riders that pedal with their heel down (a low foot angle) are recommended to have a higher knee angle than those that pedal with their toe down (a higher knee angle).

Points below the range indicate your saddle is too low and you aren't getting the best efficiency from your legs. Points above the range mean your saddle is too high and you will be reaching for the pedals and risking injury.



How to Change
To adjust your saddle height, you typically loosen the bolt that secures the seat post to the bike frame, slide the seat post up or down, then tighten the bolt again.

Saddle Fore/Aft



Description

A recommended change to the how far the saddle is positioned forward or backward based on the rider's hip angle and knee over pedal distance.

Why to Consider

Your bike is designed so that your hips should be positioned closely in line with the seat tube for proper weight distribution and the best handling. Aero and TT bikes are designed a bit differently, so on these bikes the hips should be forward of the seat tube.

What is Important

This position is crucial for several reasons:

Balance and Control

Proper saddle fore/aft position can help evenly distribute your weight over the bike, providing a good balance between the front and rear wheel. This balance can improve handling and make the bike feel more responsive and stable, particularly when climbing or descending.

Power Transfer and Efficiency

A saddle that is too far forward can limit your ability to recruit your glutes and hamstrings, which are important muscles for producing power. A saddle that is too far back might over-rely on your hamstring and place additional strain on your lower back. A correct saddle fore/aft position allows you to use all your leg muscles effectively throughout the pedal stroke, improving your efficiency and power output.

Comfort

Incorrect saddle fore/aft position can lead to discomfort in various places, such as the hands, shoulders, lower back, and even the knees. If you're too far forward, you might place extra weight on your hands and shoulders. If you're too far back, it can cause you to overreach to the handlebars, leading to lower back discomfort.

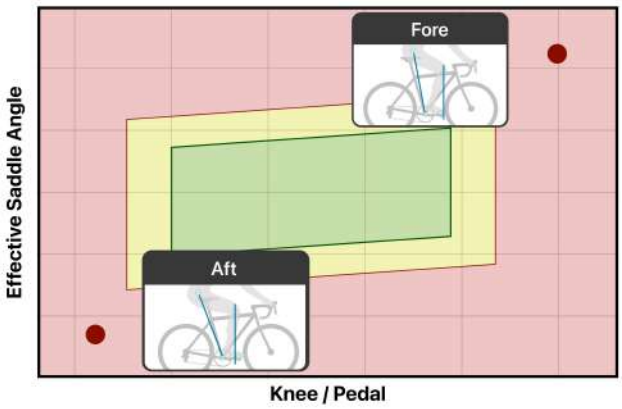
Injury Prevention

An incorrect saddle fore/aft position can contribute to several overuse injuries, such as knee pain, lower back pain, or neck and shoulder issues.

How to Interpret

Our proprietary algorithm looks at the knee over pedal distance and the hip angle to determine the optimal saddle fore/aft position. Moving the saddle fore and aft also affects optimal saddle height, so the algorithm will take both into consideration.

Points below the recommended area indicate you are sitting too far back which can cause too much weight on the back wheel. Points above the box mean you are too far forward which can place too much weight on your hands and the front wheel.



How to Change

Most bike saddles are on adjustable rails. You typically loosen the bolts that secure the saddle to the seat post, slide the saddle forward or backward on its rails, then tighten the bolts again.

Saddle Fore/Aft

Note
Changes to your arm and upper body positioning should be done through changes to the handlebar stem, not by moving the saddle fore and aft.

Rider Position

Description

An analysis of the rider position based on the torso and shoulder angles. Our algorithm characterize the riding position as Upright, Relaxed and Aggressive.

Why to Consider

The rider position is crucial for the rider's comfort and aerodynamics.

What is Important

The rider position is important for several reasons:

Comfort and Endurance

The angles of the torso and shoulder can greatly affect comfort on the bike. An uncomfortable position can lead to pain or discomfort in the neck, shoulders, back, or hands over time, reducing a rider's ability to maintain effort and speed over long distances.

Aerodynamics

The position of the rider's upper body can have a significant impact on aerodynamic drag, which is one of the largest forces a cyclist has to overcome, especially at higher speeds. A lower torso angle (closer to horizontal) and narrower shoulder angle can reduce the frontal area exposed to the wind, improving aerodynamics. However, this needs to be balanced with other factors, such as comfort and power output.

Power Output

The angle of the torso can affect which muscle groups are engaged and how effectively power is produced. For example, a more upright torso position can allow for greater recruitment of the gluteal muscles. However, excessively upright or hunched positions can inhibit effective breathing and therefore oxygen supply to the muscles.

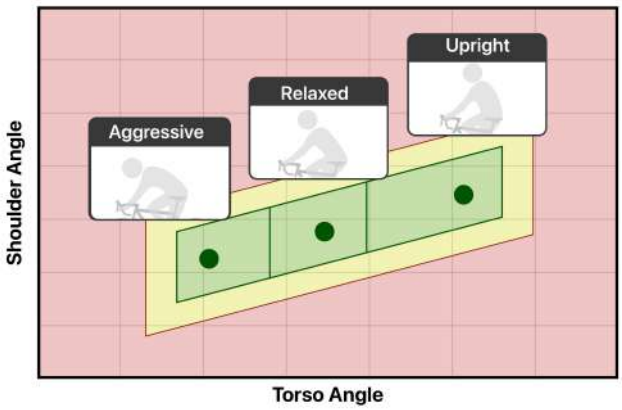
Control and Stability

The rider's upper body position can affect the handling and stability of the bike. A more upright position can provide better visibility and control, particularly in traffic or on technical descents.

How to Interpret

The rider's ability level, flexibility and goals as well as the type of bike will determine the appropriate classification of rider position.

Points above the recommended area indicate your arms might be constrained and you should consider moving your handlebars forward. Points below the box mean your arms might be stretched out too far and you should should move your handlebars closer.



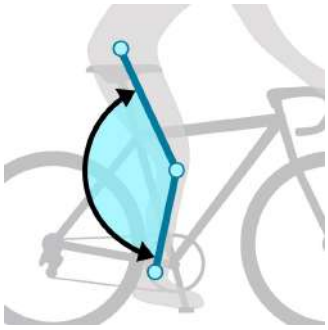
How to Change

Rider position is controlled by the position of the handlebars relative to the saddle. To change your riding position you may need to add spacers to raise your handlebar stem or change to a longer or shorter stem.

Note

The rider position is impacted by changes to the saddle height and fore/aft position. So start with the saddle positioning before moving to rider position. Do not use changes to the saddle position to change the rider position.

Knee Angle



Description
The angle formed by the hip, knee and ankle throughout the pedal stroke.

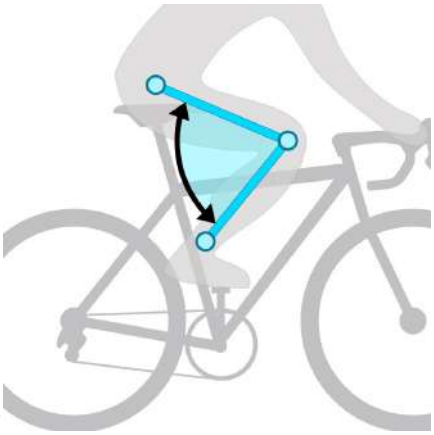
Why to Consider
It is one of the key measurements in getting your saddle height set correctly.

What is Important
The two most commonly measured points are the maximum extension (usually at the bottom of the pedal stroke) and maximum flexion (usually at the top of the pedal stroke).

Maximum Knee Extension
The Maximum Knee Extension (MKE) or the Maximum Knee Angle is found at the bottom of your pedal stroke when the crank arm is roughly lined up with the saddle tube, slightly before the very bottom of the pedal stroke.

A MKE that is too low means your saddle is too low and your legs are not working efficiently. Too high of an angle means your saddle is too high and you risk injury from overextending your knees. The range for MKE is roughly from 138° to 150°.

Maximum Knee Flexion
The Maximum Knee Flexion or Minimum Knee Angle is measured a the top of the pedal stroke.



If your minimum knee angle is too low, the knee bends excessively and places significant load on the knee at the start of the pedal stroke. The Minimum Knee Angle should not go lower than 70°. If the saddle height is set correctly and your Minimum Knee Angle is too low, you may need to try shorter crank arms.

These angles are crucial for several reasons:

Power Transfer and Efficiency
Optimal knee angles allow for the most efficient power transfer to the pedals. If the angle at maximum extension is too straight, it can limit power production and place undue stress on the knee joint. Conversely, if the knee is too bent, it could limit the range of motion and result in lower pedaling efficiency.

Injury Prevention
Proper knee angles can help prevent overuse injuries. A knee angle that is too straight at maximum extension can lead to issues like patellar tendinitis and cyclist's knee. On the other hand, a knee angle that is too acute can cause problems in the hip and lower back due to the compressed position.

Comfort
Knee angles that fall within recommended ranges tend to be more comfortable for most riders, especially over long distances. An uncomfortable knee angle can lead to discomfort or pain during or after cycling.

Muscle Engagement
Knee angle also affects which muscles are engaged during cycling. Different angles will shift the workload between the quadriceps, hamstrings, glutes, and calf muscles.

How to Change
To adjust your knee angle, you may need to change your saddle height, fore/aft position, or even the crank length.

Knee Angle

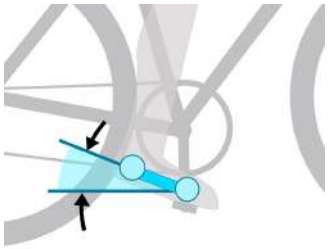
See Also

We developed an algorithm based on hundreds of professional bike fittings that looks at both the maximum Knee Angle and the Foot Angle to determine your optimal saddle height. See the Saddle Height to understand the relationship this angle has with the Foot Angle and for recommendations on adjusting your saddle height.

Note

Previous versions of Bike Fast Fit used the bottom of the pedal stroke (BDC) as the point to record the maximum knee angle. This finds the actual maximum, which is typically when the crank is in line with the seat tube and is 2-4 degrees higher the the previous maximum knee angles.

Foot Angle



Description
This is the angle of the foot relative to the ground and is formed by the heel, toes and a horizontal line.

Why to Consider
This measurement plays an important role in cycling biomechanics and overall performance.

What is Important
Here are a few reasons why it matters:

Power Transfer
Proper foot angle can optimize the transfer of power from your leg to the pedal throughout the pedal stroke. This can improve efficiency and reduce fatigue over long rides.

Comfort
An inappropriate foot angle can lead to discomfort or even injuries. If your foot is angled too far up (toes pointing upwards) or down (toes pointing downwards) it can place strain on your ankles, calves, knees, and even up into your hips and lower back.

Injury Prevention
The angle of your foot can affect the alignment of your joints during pedaling, which can influence the risk of injury. An optimal foot angle can help to reduce the risk of common cycling injuries such as patellofemoral pain syndrome or iliotibial band syndrome.

Efficiency
Optimizing your foot angle can help to engage the correct muscles at the right time during the pedal stroke, which can improve your overall cycling efficiency.

When the pedal is in the 12 o'clock position of a normal stroke (0° Crank Position), the typical foot angle is in the 20 to 35 degree range. Increasing toe down will make the top of the pedal stroke easier as more toe down moves the knee forward and better poised to start the down stroke. Less toe down flexes the hips and knees more. Riders with problems with their hips and knees may unconsciously use less toe down here. If you are having issues here, you may want to seek a professional bike fitter and consider shorter crank rams.

When the pedal is the 3 o'clock position of a normal stroke (90° Crank Position), the typical foot angle range is 0 to 15 degrees. By the this point in the pedal stroke the rider should be applying power and the foot will drop to a flatter position. Causes of being outside of this range might be poor cleat positioning or issues with your ankle and foot mechanics.

When the pedal is the 6 o'clock position of a normal stroke (180° Crank Position), the typical foot angle range is 5 to 20 degrees. Having some toe down helps ease the pedal through bottom of the stroke, but a flatter position may help finish the power of the down stroke.

Having too little toe down can be a symptom of the saddle being too low or a poorly placed cleat. Having too much may mean the saddle is too high or the cleat is too far forward.

How to Change
The Foot Angle is partially affected by the saddle height, so lowering the saddle will typically lower the foot angle and vice versa.

It is mostly affected by the pedaling technique though. Heel down and toe down refer to different pedaling techniques cyclists use and refer to the position of the foot during the pedal stroke.

Foot Angle

Heel Down Technique
In this style, also known as "ankling," the cyclist starts the downstroke with the heel higher than the toes, drops the heel below the level of the toes around the midpoint of the downstroke, and then brings the heel up again during the upstroke. This technique can potentially increase the effective length of the pedal stroke and engage different muscle groups. It was traditionally taught as a way to increase pedaling efficiency, but the evidence on its effectiveness is mixed. Some riders find it more comfortable, particularly on climbs.

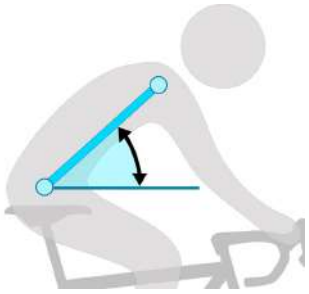
Toe Down Technique
In the toe down technique, the cyclist keeps the toes pointed down through the majority of the pedal stroke. This technique is often used by sprinters and high-cadence cyclists. Some cyclists find this technique allows them to deliver power more effectively, particularly over shorter distances. However, a very pronounced toe-down position can potentially place more stress on the calf muscles and Achilles tendon.

It's important to note that there is significant variation in pedaling technique between cyclists, and neither heel down nor toe down is universally better. The most effective pedaling technique can depend on factors like the cyclist's anatomy, bike fit, riding style, and personal preference. A neutral foot position, where the foot is roughly level through the pedal stroke, is most common and is generally a good starting point for most cyclists. However, some degree of toe or heel orientation can naturally occur depending on individual biomechanics and pedaling style.

If you're experiencing discomfort while pedaling, it may be worthwhile to work with a coach to assess and potentially adjust your pedaling technique.

See Also
The Saddle Height ranges try to take into account the interaction between the Knee Angle and the Foot Angle.

Torso Angle



Description
The angle between the horizontal and a line drawn from the hip to the shoulder when in riding position.

Why to Consider
The Torso Angle is one of the key measurements that affects your comfort and aerodynamics while riding.

What is Important
Factors to consider about the torso angle:

Comfort
A more upright torso angle (greater angle) can be more comfortable for many riders, particularly over long distances or when riding at a more relaxed pace. Conversely, a more aggressive position with a lower torso angle can lead to strain on the lower back and neck, especially over long periods of time.

Power Output
The torso angle can impact how effectively a rider can generate power. There's a delicate balance to be struck here, as a lower torso angle (more parallel to the ground) can allow for a more aerodynamic position and potentially greater power output, especially in racing scenarios. However, going too low can restrict breathing and compromise power output. Mountain bikers prefer more upright position which provides a more open hip angle and ability to generate maximum power.

Aerodynamics
The lower the torso angle, the more aerodynamic the position typically is, because it presents a smaller frontal area for wind to hit. This can be beneficial in time trials, triathlons, or any high-speed cycling where aerodynamic efficiency is critical.

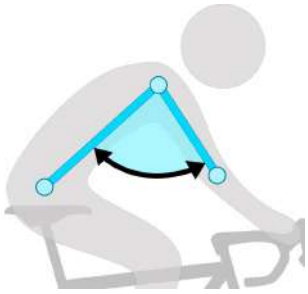
Weight Distribution
Torso angle also influences how your weight is distributed over the bike, which can affect handling, control, and the amount of weight supported by the saddle versus the handlebars.

It's important to remember that the ideal torso angle can vary significantly based on the type of cycling, the rider's body (e.g., length of torso, flexibility, core strength), and personal comfort and performance preferences.

How to Change
Changing the saddle height, saddle fore/aft or the handlebar position will change the Torso Angle.

See Also
Consulting the Rider Position recommendation can help with the balance between the Torso Angle and the Shoulder Angle.

Shoulder Angle



Description

The angle between the torso and the upper arm when the hands are on the handlebars.

Road bike shoulder angle is calculated with hands on the hoods and elbows bent about 15 degrees.

For bikes with aero bars, aero bars should be placed so rider forearms represent a column perpendicular to the weight they are supporting.

Why to Consider

The Shoulder Angle (along with the Torso Angle) plays a crucial role in both comfort and efficiency on the bike.

What is Important

Factors to consider about the shoulder angle:

Comfort

An optimal shoulder angle can help prevent unnecessary strain on the shoulder muscles, neck, and upper back. If the angle is too wide (arms extended too far), it can lead to shoulder and neck pain. If the angle is too tight (arms too close to the body), it can lead to discomfort in the upper back and affect control of the bike.

Control

A shoulder angle that is appropriate for the rider can help maintain good control over the bike, especially when steering, braking, and shifting.

Aerodynamics

The shoulder angle also affects a rider's aerodynamics. A wider angle can create a larger frontal area, increasing wind resistance. A more tucked-in position can improve aerodynamics, but it should not compromise comfort or control.

Power Output

Shoulder angle can indirectly impact power output as well. A relaxed shoulder position (around 90 degrees) can help the rider maintain an effective and comfortable position over a long period, aiding in consistent power output.

Remember, these are general guidelines. The ideal shoulder angle can vary depending on a multitude of factors including the type of bike, style of riding, individual body metrics, and personal comfort.

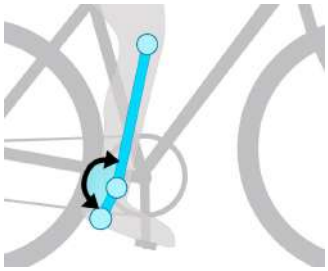
How to Change

Changing the saddle height, saddle fore/aft or the handlebar position will change the Shoulder Angle.

See Also

Consulting the Rider Position recommendation can help with the balance between the Torso Angle and the Shoulder Angle.

Ankle Angle



Description
The angle formed by the knee, ankle and heel. Represents the degree of plantar or dorsiflexion in the ankle joint during cycling.

Why to Consider
It is an essential aspect of cycling biomechanics and can have a significant impact on comfort, performance, and risk of injury.

What is Important
This measurement is important for several reasons:

Power Transfer
An optimal ankle angle can help ensure that power is efficiently transferred from the leg to the pedal throughout the pedal stroke. This could enhance cycling efficiency and reduce fatigue over long distances.

Comfort
An inappropriate ankle angle can cause discomfort or even injuries. For instance, if your foot is angled too far downward (plantar flexion) or upward (dorsiflexion) it can strain the ankles, calves, knees, and even lead to issues in the hips and lower back.

Efficiency
An optimal ankle angle allows for the appropriate muscles to be engaged during different phases of the pedal stroke, improving overall cycling efficiency.

This angle will be close to 180 degrees throughout the pedal stroke and should remain within 15 degrees. When the angle is 195 degrees, the toe is pointed down about 15 degrees (plantarflexion). When the angle is 165 degrees, the toes are pointed up about 15 degrees (dorsiflexion). The more fit and experienced the rider, the greater amount of ankle motion.

During the down portion of the pedal stroke when power is being applied, at the 3 o'clock position the angle should be close to 180 degrees to generate the most power. At the bottom of the stroke, the 6 o'clock position, the angle will be more than 180 degrees as the toe is pointed down to help finish the power stroke.

How to Change
The saddle height can have an impact on the ankle angle. Lowering the saddle height will typically reduce the ankle angle at to the bottom of the pedal stroke and raising it will have the opposite reaction.

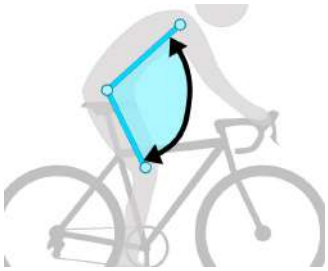
Another way to change the ankle angle is through a pedaling technique commonly known as 'ankling' that involves changing the angle of your ankle throughout the pedal stroke.

During the downstroke (12 o'clock to 6 o'clock), start with a neutral or slightly toe up position. As you push the pedal down, move into a more toe down position, reaching maximum at the bottom. During the upstroke (6 o'clock to 12 o'clock), start moving back into the toe up position, pulling up on the pedal and returning to neutral or slightly dorsiflexed at the top.

This helps engage more muscles and potentially improve efficiency. However, the degree of movement and technique can vary among individuals. It's often beneficial to work with a cycling coach or professional bike fitter for personalized advice.

See Also
This angle is closely related to the Foot Angle. Also check the Saddle Height and the Saddle Fore/Aft for more recoommendations.

Hip Angle



Description

The angle formed by the center of the knee, hip, and shoulder. The 'open hip angle' refers to the angle when the pedal is at the top of the stroke, when the knee is closest to the chest. The 'closed hip angle' refers to the angle when the pedal is at the bottom of the stroke.

Why to Consider

This angle can have a significant impact on a cyclist's comfort, power output, and aerobic capacity.

What is Important

This measurement is crucial for several reasons:

Power Output

The open hip angle can significantly influence your power output on the bike. A too tight hip angle (i.e., your chest is too close to your thighs) can limit your ability to fully engage your gluteal and quadriceps muscles, potentially reducing your power output.

Breathing

A tighter hip angle can restrict your diaphragm, making it harder to breathe, especially during hard efforts. On the other hand, a more open hip angle (i.e., your torso is more upright relative to your thighs) can facilitate easier breathing.

Comfort

Comfort on the bike is influenced significantly by the open hip angle. If the angle is too tight, it can lead to discomfort in the hips and lower back. Conversely, if the angle is too open, you may feel like you're overextending with each pedal stroke, which can lead to different discomforts and inefficiencies.

Recreational riders and those with less flexibility, the open hip angle (top of the pedal stroke or the 12 o'clock position) should be greater than 55 degrees. Riders with greater fitness and flexibility can go lower, from 45 to 55 degrees.

How to Change

Lowering the saddle height cause the angle to get smaller as the knee gets closer to the chest. Conversely, raising the saddle will cause the angle to get greater.

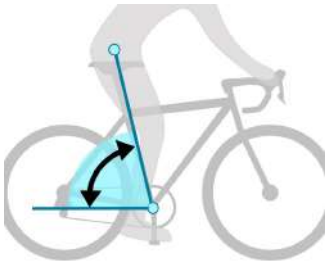
A more aggressive handlebar position, longer and lower, will also make it lower by moving the chest closer to the knee.

The length of the crank arm will also affect this angle, as a longer crank arm will push the knee higher and make the open hip angle lower. A shorter crank arm will have the opposite effect.

See Also

Check the Saddle Height, the Saddle Fore/Aft and Riding Position for more recoommendations.

Effective Saddle Angle



Description
The angle between the center of the bottom bracket (BB), the hip and a horizontal line.

Why to Consider
This angle can serve both as a proxy for Seat Tube Angle, but it also shows the actual position of where the rider is sitting. This angle plays an important role in determining the bicycle's handling characteristics and the rider's position over the pedals.

What is Important
Here's why it's important:

Different types of bikes have different typical seat tube angles. For example, road bikes often have a slacker seat tube angle, while time trial or triathlon bikes have a steeper angle. It's also worth noting that the effective seat tube angle can be adjusted to some extent by moving the saddle forward or backward on its rails, although this also affects other aspects of bike fit such as reach to the handlebars.

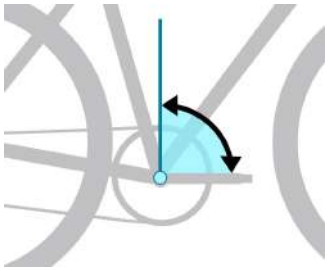
Time Trial (TT) and Triathlon Bikes
Time trial (TT) and triathlon bike setups often differ significantly from standard road bike setups. The primary aim of these setups is to achieve an aerodynamic position that can be held for the duration of the race while still allowing for efficient power output.

The saddle on these bikes is typically positioned more forward and the rider often will move more to the nose of the saddle, which results in a steeper effective seat tube angle. This forward position allows the rider to rotate their hips forward, achieving a more aerodynamic position by lowering the torso and bringing the arms and shoulders closer to the horizontal.

How to Change
While the angle of the seat tube is set with the bike design, the effective angle can be changed by moving the saddle fore or aft and the rider's positioning on the saddle. As with many variables on the bike, changing one thing affects many others, so be sure to look at the Saddle Fore/Aft recommendations when adjusting.

See Also
See the Saddle Fore/Aft to understand the relationship this angle has with the Knee over Pedal and for recommendations on adjusting your saddle. Also see the Seat Tube Angle to understand the importance and implications of this angle.

Crank Position

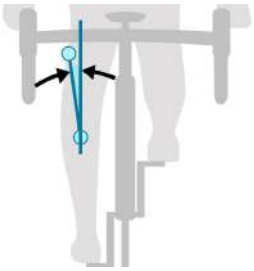


Description
The angle formed by the bottom bracket, crank arm and vertical line.

Why to Consider
This is often the reference point for various measurements and adjustments in a bike fit.

What is Important
The crank position starts at 0 degrees when the pedal is at the top of the stroke to 90 degrees when the crank is horizontal to 180 degrees when the pedal is at the bottom of the stroke. The angle is clockwise for the right side of the bike and counter clockwise for the left.

Knee Tilt



Description

The inward or outward angle of the knee from the top to the bottom of the pedal stroke.

Why to Consider

While the hip and the foot are connected to the bicycle, the knee moves independently. Excessive inward or outward movement of the knee can be a precursor to knee pain.

What is Important

Understanding and addressing knee tilt is crucial for a few reasons:

Injury Prevention

Excessive knee tilt can lead to biomechanical inefficiencies that increase the risk of overuse injuries, including patellofemoral pain syndrome, IT band syndrome, and others. It can lead to uneven loading of the joint, which over time can cause discomfort and injury.

Efficiency and Power Transfer

A knee that tracks straight up and down in alignment with the hip and ankle during the pedal stroke allows for more efficient power transfer. If your knee tilts inward or outward, it can lead to a loss of power because not all your force is being applied directly down into the pedal.

Comfort

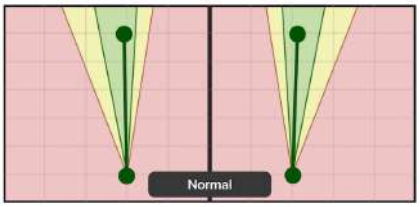
Excessive knee tilt can lead to discomfort during cycling, especially on longer rides. This discomfort can affect your enjoyment of cycling and your ability to perform long-term, consistent training.

How to Interpret

Knee Tilt problems can have a variety of causes and corrections, so the algorithm compares both knees at top and bottom of the pedal stroke and classifies the pattern as one of the following:

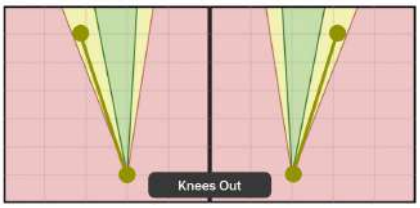
Normal

During the pedal stroke the knee is moving relatively straight up and down in alignment. No changes are recommended as a bit of knee movement is normal.



Knees Out

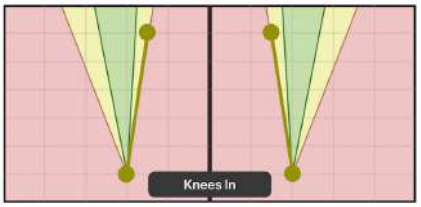
Rather than moving straight up and down in alignment with the hip and ankle, the knee is deviating outward, especially noticeable at the top of the pedal stroke. This can be caused by a variety of factors, so finding the right fix may require some experimentation.



Start by looking at the Saddle Height as this is often caused by a saddle set too low. Moving the cleat towards the inside of the shoe will widen the stance on the pedals which may also help. Cleat wedges to tilt the foot may help. In addition, targeted strength and flexibility exercises may help strengthen the knee and prevent outward tilt. Look at exercises like the deadlift, lunge, squat and step up.

Knee Tilt

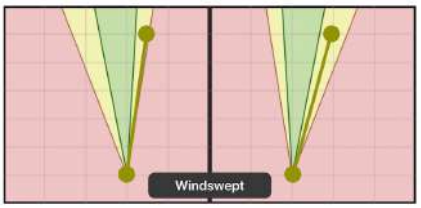
Knees In



Refers to the knee moving inward toward the midline of the body during the pedal stroke. Again, this may be caused by a variety of factors.

Check the Saddle Height to ensure the saddles isn't too high or low. Moving the cleat position to the outside will narrow the stance on the pedals which may help. The foot may be tilting or rotating in the shoe. Better shoe footbeds or insoles may help. This may be caused by the glute not stabilizing the leg enough, so exercises such as single leg touch down and core exercises may help.

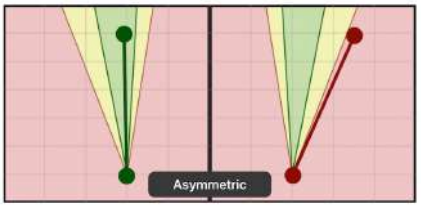
Windswept



In this case, one knee if moving inward and one knee is moving outward during the pedal stroke.

This is typically caused by the rider not sitting squarely on the saddle or a saddle that is not aligned straight on the bike. Fixing this can be challenging and may require changes to the saddle tilt or a different type of saddle. It can caused by excessive pelvic tilt and be affected by changes to the position of the upper body and hands.

Asymmetric



With this case, the knees have different tracking patterns. This can be caused by anatomical or muscular strength differences between the right and left side of the body. It can also be caused by inconsistent cleat positions on the right and left foot.

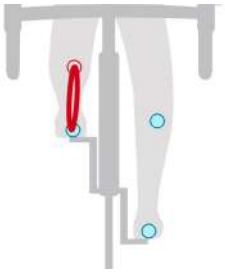
See Also

Knee Tilt and Knee Tracking are slightly different views on the movement of the knee.

Note

Remember, making changes to your bike fit or alignment should be done gradually, and it's important to test each change to see how it affects your overall comfort and pedaling mechanics.

Knee Tracking



Description
The path the knee follows throughout the pedal stroke.

Why to Consider
Ideally, your knees should move up and down in a straight line, aligned with your feet and hips. Excessive movement of the knee can be a precursor to knee pain.

What is Important
The importance of knee tracking is crucial for:

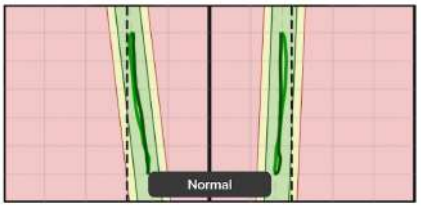
Injury Prevention
Incorrect knee tracking, such as the knee moving excessively inwards or outwards during the pedal stroke, can lead to uneven joint loading and strain on the soft tissues around the knee. Over time, this can result in overuse injuries such as patellofemoral pain syndrome or iliotibial band syndrome.

Efficiency and Power Transfer
When your knee tracks correctly over your foot and pedal, your body can generate and transfer power more effectively. Misaligned knee tracking can cause power loss since not all the force you're generating goes directly into driving the pedal down.

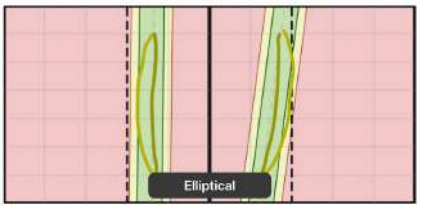
Comfort
Proper knee tracking helps maintain comfort during cycling, especially over longer distances. Improper tracking can lead to pain or discomfort in the knee joint, which can disrupt your cycling experience and performance.

How to Interpret
Knee tracking problems can have a variety of causes and corrections, so the algorithm analyzes the path of the knee through a pedal stroke and classifies the pattern as one of the following:

Normal
During the pedal stroke the knee is moving relatively straight up and down in alignment. No changes are recommended as a bit of knee movement is normal.



Elliptical
Rather than moving in a vertical path, the path forms an ellipse. This can be caused by: the saddle height being too high or too far back; your cleat position may be off; muscle imbalances in your hips or legs; or tight muscles in your hips or legs.

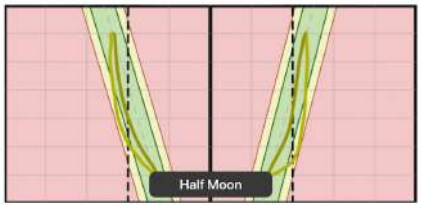


To correct elliptical tracking, start with making sure the saddle height and fore/aft are correct. Make sure the cleat are positioned to allow the feet to feel natural and comfortable. Flexibility and strengthening exercise for the legs and hips may also help.

Knee Tracking

Half Moon

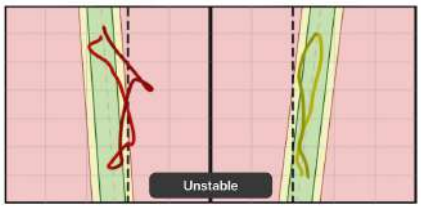
Where the knee follows an inward or outward curve during the pedal stroke. This can be caused by a saddle that is too high leading the hips to rock side-to-side. Anatomical factors such as a difference in leg lengths, bow legs or knock-knees can also be cause.



Similar to elliptical tracking, to correct this type tracking, first check the saddle height and fore/aft followed by checking the cleat positions.

Unstable

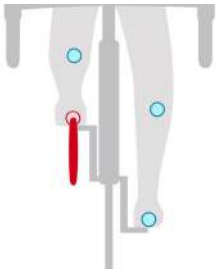
In this case there is too much variation in the path to determine the path type. This is typically caused by a poor quality video recording. See Toe Tracking for more details.



See Also

Knee Tilt and Knee Tracking are slightly different views on the movement of the knee. Also see Toe Tracking for more information on getting a high quality recording.

Toe Tracking



Description
The path the front of the shoe (toe) follows throughout the pedal stroke.

Why to Consider
As the foot is fixed to the pedal, the path should be up and down in a straight line. The consistency of this path is used to determine the quality of the recording and tracking for the Knee Tilt and Knee Tracking. The path is also used to facilitate corrections for parallax and rotation of the device while recording.

What is Important
To ensure a recording with good tracking, consider the following factors:

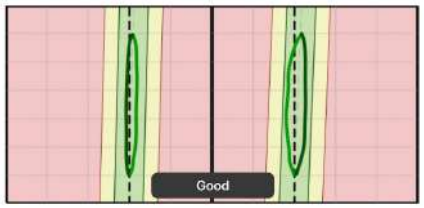
Lighting and Obstructions
The app tracks the body visually, so it is important that there be subject be well lit and there are no obstructions.

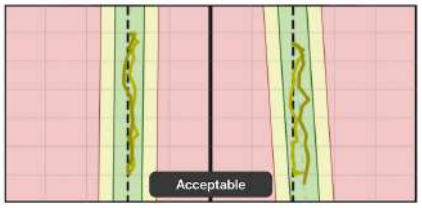
Clothing
Again, as the app is visually tracking the body points on the body, the clothing the rider is wearing can impact the quality of the recording. Avoid loose fitting clothing that can obscure the body parts. All black leggings can also be a challenge in low lighting conditions.

Camera Stability
The algorithm is analyzing small differences in the path of the knee and toes, so the stability of the camera is crucial for accurate tracking. Ideally the recording device should be mounted on a tripod. An improvised stand for your device can be easily fashioned from a scrap piece of cardboard.

How to Interpret
The app analyzes the path and classifies it as:

Good
The application was able to track the toes well. A wider path on one side or the other is normal and just indicates the device was slightly off center.

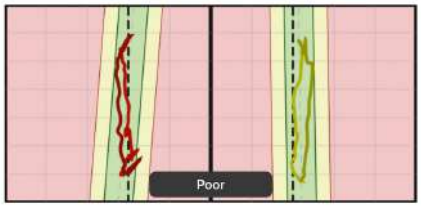




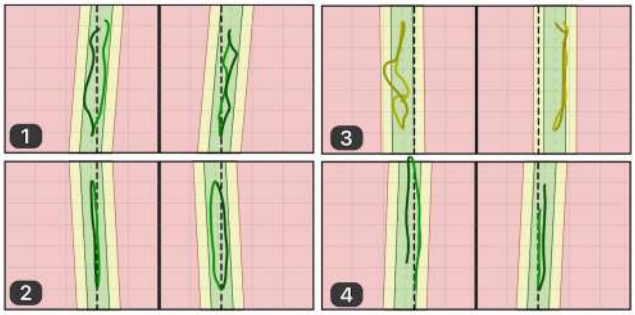
Toe Tracking

Acceptable
There were some errors in the tracking, but the it was acceptable enough that the measurements are reliable.

Poor
There were significant errors in the tracking and the other measurements in this recording should be viewed with suspicion.



Examples of Tracking Problems
Here are some examples of how issues with the recording are seen in the tracking:



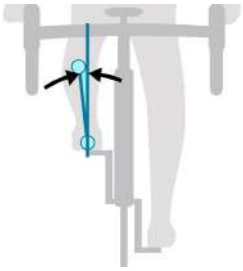
1. Camera Moved
The application was able to track the toes sufficiently as seen by the smooth path, but the waviness indicates the device was moving around during the recording.

2. Camera Not Level
While the tracking was smooth and the camera was stable, the tracks are rotated the left indicated the device was not level.

3. Obstruction
The extreme waviness in the middle of the toe track indicates there was likely a visual obstruction. This often happens when there is a brace holding up the front of the bike that blocks the view of the toe during a potion of its path.

4. Out of Frame
In this case the device wasn't aligned correctly or was too close such that the toes went below the bottom of the video frame. If the app can't see the toes, it can't track them.

Right Knee Angle



Description
The inward or outward tilt of the knee relative to the toe and the vertical plane during the pedal stroke.

Why to Consider
It's a measure of how your knee tracks as you pedal.

What is Important
Here's why it's important:

Efficiency
A properly aligned knee tilt angle ensures you're able to produce maximum power and pedal with the most efficiency. If the knees aren't tracking vertically, you could be losing energy in lateral movements, which reduces your overall pedaling efficiency.

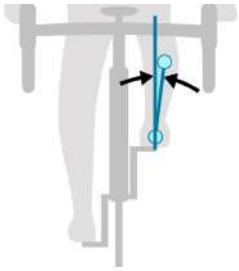
Injury Prevention
Misalignment, either excessive inward (varus) or outward (valgus) knee tilt, could lead to an overuse injury over time. This is due to the strain placed on the knees, as well as the potential for uneven load distribution across the joint. Conditions like patellofemoral pain syndrome, IT band syndrome, and other forms of knee pain are common in cyclists with improper knee tilt.

Comfort
If your knees are tilting excessively inwards or outwards, it could lead to discomfort during rides. Maintaining a proper knee tilt angle ensures that the movement feels natural and comfortable, reducing the likelihood of discomfort or injury.

How to Change
Addressing issues with knee angle might involve changing the saddle height, adjusting the cleat position, changing the Q-factor (the distance between the pedals), using orthotics or wedges, or even addressing strength imbalances or flexibility issues off the bike.

See Also
See the Knee Tilt and Knee Tracking recommendations for more information on how to interpret and adjust.

Left Knee Angle



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A properly aligned knee tilt angle ensures you're able to produce maximum power and pedal with the most efficiency. If the knees aren't tracking vertically, you could be losing energy in lateral movements, which reduces your overall pedaling efficiency.

Injury Prevention
Misalignment, either excessive inward (varus) or outward (valgus) knee tilt, could lead to an overuse injury over time. This is due to the strain placed on the knees, as well as the potential for uneven load distribution across the joint. Conditions like patellofemoral pain syndrome, IT band syndrome, and other forms of knee pain are common in cyclists with improper knee tilt.

Comfort
If your knees are tilting excessively inwards or outwards, it could lead to discomfort during rides. Maintaining a proper knee tilt angle ensures that the movement feels natural and comfortable, reducing the likelihood of discomfort or injury.

How to Change
Addressing issues with knee angle might involve changing the saddle height, adjusting the cleat position, changing the Q-factor (the distance between the pedals), using orthotics or wedges, or even addressing strength imbalances or flexibility issues off the bike.

See Also
See the Knee Tilt and Knee Tracking recommendations for more information on how to interpret and adjust.