



# BikeDynamics

Bike Fitting Specialists

A good saddle is an essential factor in cycling efficiency and comfort but needs to be used in conjunction with a well set up bicycle. Bike fitting is the term used to describe the geometrical set up of a bike and rider, i.e. the relative positions of pedals, saddle and handlebars to ensure optimum performance, endurance and comfort.

Many simple rules exist for setting up bicycles but we can also take a more scientific approach to finding a perfect position. The BikeDynamics fitting process is to start at the feet and work around to the hands.

## Foot to Pedal

The general rule is for the ball of the foot to be over the pedal spindle. The 'ball' can cover quite a large area so we can be more precise by defining it as a horizontal line at the end of the first three metatarsal bones. The first one is quite easy to find as it is the bony lump at the base of your big toe, the second and third are still bony but smaller and make take a little prodding to find them. If using cleats, there is usually a mark on them that aligns with the pedal spindle when the cleat is engaged. The cleat should be attached to the shoe such that this mark is directly under the 'ball' of the foot.

The cleat position should also accommodate the natural toe in or out of the feet. Look down at your feet whilst standing, walking and dangling your feet from a high chair or table. Try to replicate your natural foot position when on the pedals. Very 'toed out' people may find their heels clash against the crank arms or frame and will either need to adjust the cleat to move the shoe as far outboard as possible or straighten the shoe up a little. Extreme cases may even need to space the pedal out with a washer.

## Saddle Height.

The old favourite rule for saddle height is to set it such that you have a straight leg if you put your heel on the pedal. The logic here is sensible in that you do need to have a small bend in the knee when at full extension. This method is a little imprecise though as the ideal knee angle at full extension (when measured dynamically) is approximately 143-148°. If the saddle is lower, you lose power as you are not fully able to utilise the power from your quads. If the saddle is higher you may have to stretch down to reach the pedals, causing sores as you rock and slide over the saddle. Often when changing saddle height the knee and ankle can open or close together or independently. With the knee at 145° the heel should be higher than the pedal with the foot pointing down slightly. Once the maximum knee extension has been set we need to check the minimum angle. Angles below 65° to 70° will see an increase in shear forces within the knee joints and should be avoided. This is usually caused by the bike having crank arms that are too long for the rider. The best way to measure knee angle is dynamically whilst on a stationary turbo trainer. A good approximation can be made statically with help from a friend and a simple goniometer, in which case the maximum knee angle should be set at 150°.

## **Saddle Setback**

The favourite rule for the fore and aft position of the saddle with respect to the crank centre is called KOPS (Knee Over Pedal Spindle). When the crank arms are horizontal the tibial tuberosity (bony lump below the kneecap) of the forward knee should be directly over the pedal spindle. This is usually checked using a plumb line. Many people question the validity of the KOPS rule as there is no biomechanical justification for it. It does work though because it places the rider's centre of gravity directly over the pedal spindle when forces are highest in the second quadrant of the pedal stroke. A saddle that is too far backwards should be avoided but coming forwards is less of a problem and can be a good compromise to achieve a good position on the handlebars.

## **Handlebar Position**

Cyclists need to lean forward to transfer weight from the lower spine onto their sit bones and arms and to become more aerodynamic. The handlebar reach and vertical distance to the saddle will define the torso angle which will normally be between a touring  $45^\circ$  and a  $<20^\circ$  time trial posture.

On dropped handlebars, the hands should fall naturally to a position on the hoods. This will allow a more relaxed position up on the bar tops whilst ensuring the drops are also accessible. When on the hoods the upper arms should be at an angle of approx  $80^\circ$  to  $90^\circ$  to the torso. This will enable a small bend at the elbow, helping with shock absorption and reducing tension in the neck and shoulders.

See [BikeDynamics.co.uk](http://BikeDynamics.co.uk) for more detail on all of the above.

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