Optimising Bike Set Up to Maximise Cycling Performance and Minimise Overuse Injuries

Trish Wisbey-Roth
Masters Sports Physiotherapy (AIS/UC)
Past Australian Cycling Team/Olympic Physiotherapist
Specialist Physiotherapist (FACP)

The interaction between the Athlete's body and the sporting equipment used in cycling is highly complex and influenced by many variables including the anthropometric measurements of the cyclist, their flexibility, cycle specific strength and even neural mobility. Other factors that can affect performance include O2 consumption, physiological efficiency and resistance caused by wind drag, while riding position will directly influence the power that can be produced. Optimising riding position within the comfort ranges of the cyclist's biomechanical limitations therefore becomes very important to not only minimise injuries but also optimise performance.

There may be many individual variations that are important to take into account when determining the ideal bike set up. Some of these factors will include the number of kilometres ridden per week, the importance of aerodynamics to the athlete (wind resistance is approximately 90% of the resistance to the bike moving forwards), the terrain/bike type being used, and the athletes preferred posture on the bike (riding "on the hoods" or "down in the drops").

Physiotherapists have the unique skill to perform a detailed musculoskeletal screening to assess spinal/ neural mobility, hip and lower limb mobility and muscular strength prior to adjusting bike set up. This additional athlete specific information is highly important to factor into the individualised position of the athlete on the bike.

When doing Cycling Biomechanical set ups in the clinic, the **ideal seat height** is determined using the following equation:

Ideal Seat Height = 0.98 x (lower limb leg length + cleat thickness).

Lower Limb Leg Length = height of the highest point of the Greater Trochanter to the floor. This is measured vertically with a tape measure without shoes, and the feet approximately pedal width apart with weight bearing symmetrical. When the cyclist has different leg lengths, determine the seat height using the shorter leg measurement until a Scanogram is ordered to confirm leg length difference.

Figure 1 Leg length measurement from Trochanteric height.

Cleat Thickness can vary significantly from 10 to 40mms and in the typical road cycling shoe this should be measured with tape measure without shoes and added to the leg length measurement. This prevents the athlete standing on the cleat while being measured and therefore being measured in a plantar flexed (and therefore longer than true leg length) position. The newer type Hybrid or Mountain bike shoes where the cleat is recessed into the shoe and the athlete can stand plantar grade allows a combined shoe thickness and leg length measurement to remain quite accurate.

Adjusting Seat Height The above equation provides the "ideal" seat high from the centre/top of the saddle to the centre of the pedal axel when the crank arm is positioned in line with the seat tube.

Keep in mind that this measurement is ideal only if the cyclist has good cycle specific strength and stability, optimal spinal, hip flexion, hamstring, neural and upper limb mobility. In reality most cyclists that Physiotherapists see for bike set up present with a history of injury. It is therefore very important the cycle specific musculoskeletal findings are taken into account when individualising the set up.

What to consider when the original bike seat height was well below the ideal: These cyclists often present with hip restriction, ITB or knee issues as knee compressive forces are increased with increased knee flexion on the bike.

Practical experience has shown that when the athlete is use to a lower seat height it is best to not raise the seat above **0.96** x (lower limb leg length + cleat thickness) initially. This will allow the cyclist to gradually get accustomed to the longer hamstring and calf length, greater hip flexion and increased neural mobility required as the seat is raised. Encourage the cyclist to only ride at a recovery ride (E1 effort)

level for the first 2-3 weeks and minimise big hills while the muscle recruitment patterns and cycle specific flexibility adjusts to the new bike position. Studies have shown that moving toward the ideal seat height increases recruitment of both the gluteals and the gastrocs, while lower limb muscle groups will function close to their maximal length. It is therefore a good idea to inform the cyclist that they may feel muscles working differently and to let you know if they find the adjustment in position too big a change. As many cyclists are very sensitive to joint angle and muscle length changes in the cycling position, it may be worthwhile to increase the seat height by no more than 10mms at time, particularly if the seat was positioned very low to begin with.

What to take into account when the original bike seat height was well above the ideal: These cyclists often present with back pain , sciatic nerve irritation, excessive side-to-side movement on the seat and sometimes neck and upper body neural symptoms from the overstretch position.

For the cyclist to have any chance of optimising cycling position the seat must be brought down to the ideal seat height measurement of **0.98** x (lower limb leg length + cleat thickness). This position will allow effective recruitment of gluteals and calf muscles as well as unloading the overstretched hamstring and neural structures. Dropping the seat to the ideal height will also allow the athlete to drop their heel through the bottom half of the pedal cycle and pull back on the cleat pedal providing a much more efficient pedal action. As the bike works on reaction forces to propel it forward, the most effective and efficient pedal action for a cyclist is to in fact pull back on the pedal from half way through the down stroke through the bottom of the pedal action. A good cue for the cyclist is to think of scraping mud off the bottom of their cleat.

When dropping the seat warn the cyclist that their motor patterning may significantly change and it can take several weeks for the body to adjust to the new joint angles and muscles lengths involved in the new lower seat position. They often report they can not find their ”climbing muscles” initially after adjusting a seat down in height.



Forward/Backwards seat position: Once the seat height for the individual athlete has been decided on, the seat itself can be moved forwards or backwards to minimise forces at the knee and reach to the handlebars (handlebars can also be moved up/down, shorter/longer handlebar stem). This final measurement is taken on the front leg when both cranks are positioned in the horizontal position. Drop a plumb bob or Laser vertically down from the inferior pole of the patella and it should fall within the centre of the pedal axle.

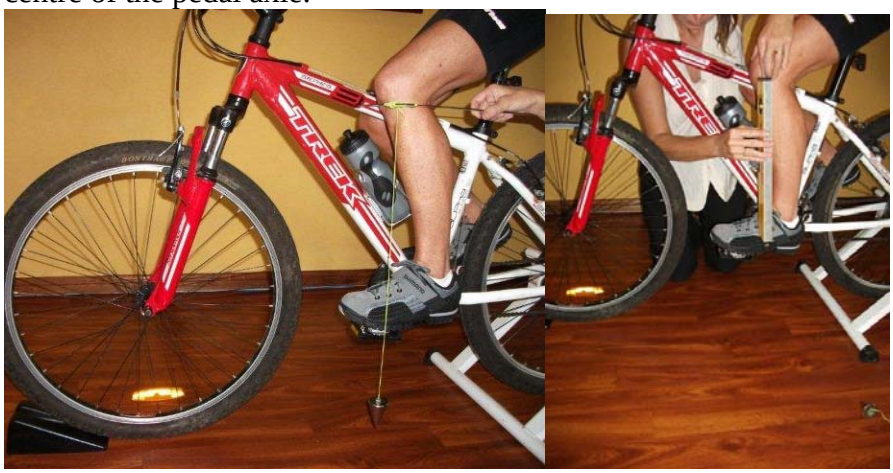
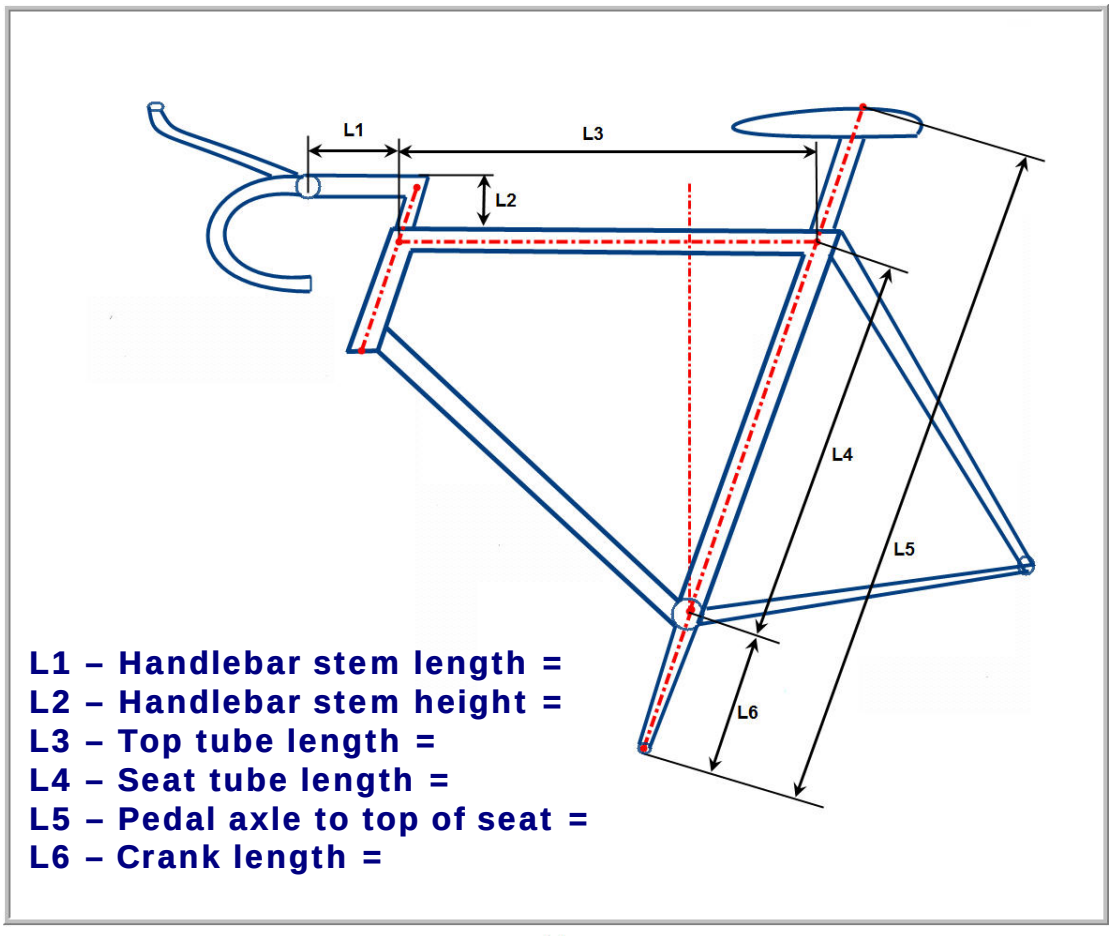


Figure 2:
Measurement of knee position over pedal axel, which is influenced by seat fore/aft position. Can be measured with Plumb bob or laser.

Enjoy combining your skill as a Physiotherapist, your knowledge of the cyclist musculoskeletal abilities and these basic bike set up tips to optimising your cyclist's biomechanics. Interested in learning more: Trish is running Cycling Biomechanics Courses in Sydney on Sunday March 7th and Sunday September 19th 2010



L1