Organic Motion Cycling

Cycling Biomechanics and the Hip

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In this article I aim to describe the muscles of the hip that are involved in the pedalling action, the effect of incorrect bike position on the hip joint and the importance of hip joint muscle balance in cycling in the prevention of overuse injury.

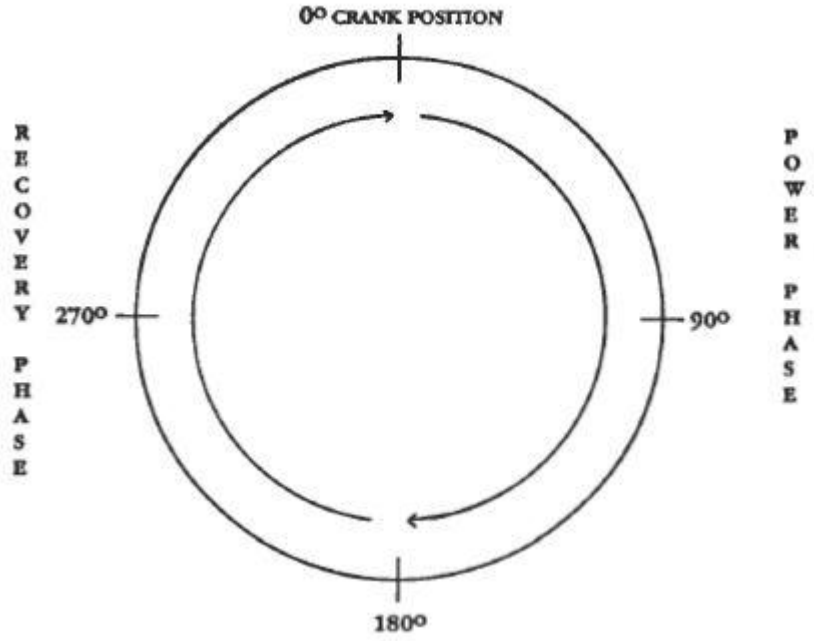
For full anatomical detail of the hip go here - http://en.wikipedia.org/wiki/Hip
Detail of the hip extensor muscles go here - http://en.wikipedia.org/wiki/Hip_extensors
Detail of the hip flexor muscles go here - http://en.wikipedia.org/wiki/Hip_flexors

As with all bipedal locomotion, the hip is the driving force for dynamic movement of the lower body. The hip joint is surrounded by musculature that enables it to move the leg:

Fore and aft – extension and flexion
Medially and laterally – adduction and abduction

A seated cyclist will engage all the muscles of the hip at various phases of the pedal stroke. Using electromyography biofeedback scientists have been able to isolate the individual hip muscles that are activated during the entire power and recover phase of the pedal stroke.

The 'Power and Recovery Phase' diagram below represents the bicycle crank with 0° at the 12 O Clock position on the crank face.



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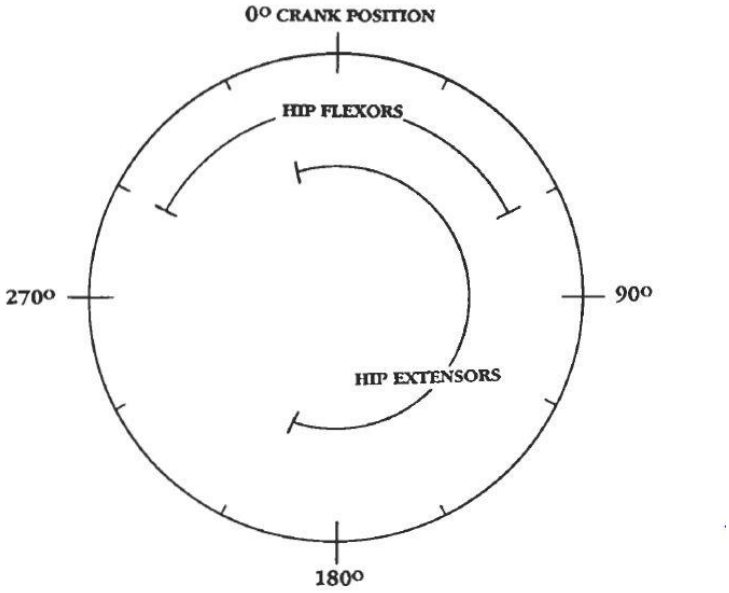
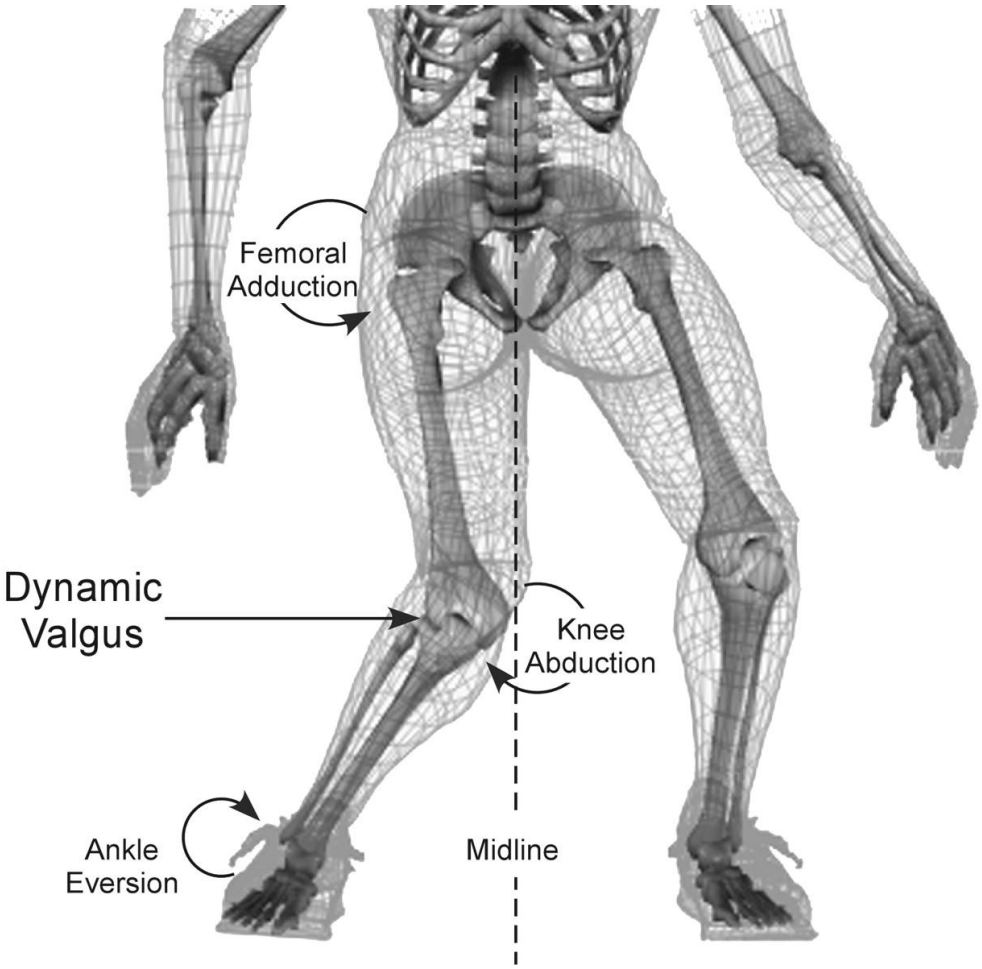
Starting at 0° the gluteus maximus activates to extend the hip for the first 45° of the pedal stroke. During the last 45° to the position just after 180° the hamstrings are activated. From 45° to 125° the gluteus maximus and hamstrings work together to extend the hip. During the recovery phase the hip flexor muscles, the iliopsoas and the rectus femoris are activated and continue the motion of the hip. The rectus femoris contracts during the last stage of the recovery phase to flex the hip in preparation for the next pedal stroke.



With the complex range of hip muscle activity during cycling it is important for the cyclist to maintain flexibility and muscle balance across all the muscles that act on the hip joint.

From a bike fitting perspective the hip angle is an important measure for professional biomechanical bike fitters who will aim to keep the optimal joint angle range based on the flexibility of the individual and the type of cycling that will be undertaken. This will differ significantly between road, triathlete, time train and cross country mtb riders. The angle of the hip is measured from anatomical points on the acromion (at the top of the shoulder) to the greater trochanter (ball and socket joint of the hip) and the lateral femoral condyle (middle of the knee joint). Ensuring an optimal hip angle is important to ensure that the cyclist is delivering optimal power, reducing the risk of overuse injury and ensuring that oxygen intake is optimal.

A common hip muscle weakness among cyclists is the abductor gluteus medius which runs along the outside of the hip. This muscle is an important contributor in keeping the knee tracking correctly and preventing it from moving toward the top tube of the bike.



Weakness of the gluteus medius and incorrect leg alignment during the pedal stroke can cause soft tissue damage in the short team and cartilage damage and arthritis in the long term.

Although the focus of this article is on the hip the body does not work in isolation. Movement from the hip initialises the entire kinetic chain of the leg to effect a specific action. Any imbalances or weakness starting from the hip will have an impact further down the chain at the knee, ankle and foot.

Cycling is a repetitive activity. Cycling at an easy 12mph at an average cadence of 60 rpm translates to 4500 revolutions of the hip in just one hour. Maintaining core strength, Flexibility along with a professional bike fit with help to position the cyclist on the bike to ensure optimal power deliver while alleviating the risk of overuse injury.

References:

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