# Triathlon: Bike

by Tommi Paavola (first published on PTonthenet.com in August 2009)

Triathlon is a reasonably young sport being born during the early part of the 19th century in France. Running and swimming have been accessible since man first walked the earth. However, the later invention of the sport of cycling certainly delayed the establishment of the sport we now know as triathlon. Triathlon as we know it today wasn't possible until the technology had advanced to a state where manufacturing of a bicycle was possible. A bike most definitely is an ingenious invention that harnesses the human body as an engine in an effective way. Simultaneously, it also exposes our movement system to new adaptations we have to consider in training and conditioning.

**Figure 1 - Muscles on Two Wheels**

This article examines some of the physiological adaptations of cycling in the muscular system. The goal is to learn how to "neutralize" the negative effects of cycling and optimize the overall triathlon performance.

**The Bike as a Movement Environment, the Body as an Engine**

Running and swimming don't quite involve mechanical technology as much as cycling, although the high-tech running shoes and shark suits are certainly influencing these sports. Moving fast on two wheels is different though, and the external force transmission device, the bike, changes some things for the athlete.
Suddenly, it's not so much about the fundamental motor programs anymore. In cycling, we have exchanged our basic motor patterns for a more specialized movement with an equipment-driven posture and position. The gait-like foundational alternating leg pattern still exists, but the arms and upper body are fixed, and the body is flexed forward in order to minimize the air resistance and to please the gods of speed.

**Figure 2 - Extreme Aerodynamics with Full Hip Flexion**

Cycling differs from running and swimming by its four-point fixed position that is determined by the bike adjustments, among other things. Due to the fixed position and the "restricted" path of movement, in time, the repetitive motion with time forms a soft tissue "mold" in the body. This adaptation will eventually hinder movement like running or swimming and put the body at risk of an injury. As a trainer of someone, who aims to perform well on wheels, on foot and in the water, my job is to acknowledge all the adaptations of the given sports and how they influence each other. By doing this, I will be more prepared to neutralize the negative and accentuate the positive in my athlete's performance.

## Cycling: Movement Analysis as a Foundation for a Training Program

A basic biomechanical and physiological understanding of the sport helps us in designing effective training regimens. We can analyze the sport movement in many ways. In the following illustration, we will focus on the “negative” adaptations of cycling. “Negative” refers to effects that potentially decrease the level of performance or increase the probability of an injury. In order to choose the correct exercise progression for a cyclist, it is essential to know the potential movement limitations caused by the sport specific position.

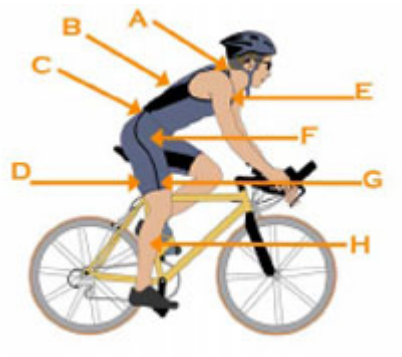


**Figure 3 - Cycling Position**

### CYCLING - PHYSIOLOGICAL AND BIOMECHANICAL CONSIDERATIONS

**A) Cervical spine extended** - The body position is forward flexed, but the eyes stay level with the horizon. The neck extensor muscles may become shortened.

**B) Middle back/thoracic spine immobile** - The absence of rotation and the spinal extension can lead to a flexed spine “mold.” This has many consequences, such as a decreased abdominal wall loading and a decreased ability to rotate.

**C) Lower back in flexion** - Back muscles get stretched out during the extended flexion. This could contribute to weakness of the lower back muscles.

**D) Pedaling range of motion (hamstring)** - The seated position and the pedaling motion may cause muscular imbalance in the hamstrings and other muscles in the region (popliteus, etc).

**E) Leaning forward, gripping the bars** - Cyclists “carry” a part of their body weight by leaning on the handle bars. This emphasizes the forward flexed “mold” and decreases the multi-planar function of the shoulder and the scapulae.

**F) Pedaling range of motion (hip flexors)** - A cyclist rarely reaches a full hip extension. The flexion-dominant range of motion and the pedaling motion (pulling) lead to shortened hip flexors and potentially to inactivity and weakness in the hip extensors.

**G) Knee on a “fixed” track** - The seated position with the fixed foot can over time lead to imbalances between the quadriceps muscles. The stability of the knee may be compromised as the inner portion (vastus medialis) becomes more inactive and the outer portion (vastus lateralis) becomes relatively more active and “tight.” This also connects to the iliotibial band problems.

**H) Shoes “clipped” in, the foot as a lever** - The foot functions as a transmitter of forces from the big prime movers to the pedals. Depending on the riding style and the use of the pedals, the calf/shin musculature can become chronically imbalanced (tib. anterior, gastrochnemius).

### The Order of Importance in Exercise Selection

The most important objective of off-bike training and conditioning is to ensure that the body’s foundational force production system is functioning optimally. After the foundational movement elements have been restored, we can start to think about building strength, power, speed and endurance.
By restoring these fundamental movement elements, we will surely enhance overall performance and most likely the cycling performance as well. All too often, we try to give the body training stimulations that it is not prepared to receive and adapt to. By optimizing the basic movement first, we will have a much wider and safer platform to build the house of performance on. When discussing the training of a “busy” multi sport athlete in particular, we need to focus on the most important goals and prioritize the exercise progressions carefully.

Priority order for choosing the exercises:

1. Reverse and prevent (flexibility, mobility)
2. Activate and recruit (stability, strength)
3. Build and enhance (specialized strength, power)

**The concept and use of "reverse" movements**

To restore = to return to a former or normal state, or position.
To reverse = to turn backward, in an opposite position or direction, upside down or inside out. (Webster's New World Dictionary)

Jo McRae, who has been working with Cervelo Team Rider Dan Lloyd, has found ways to improve Lloyd's alignment on the bike. This is how Dan Lloyd describes the benefits of the exercises: "Many of the exercises are designed to strike a balance, so it's almost like stretching everything back the other way. As a cyclist, you spend hours on a bike, hunched over in a quite unnatural position. As a result, there are parts of you that are always tight, such as your chest or your hamstrings… The aim is to stretch you out so that your posture is better off the bike, and hopefully it will stop me walking like an ape. On the bike, your back is curved, so one of the stretches is to curve it the other way to straighten it out." (Cycling weekly Spring -09, Health and Fitness section, p.117)

This is eventually the key concept of reversing the movement. You stay flexed for hours on the bike, so now you should do extension movements to neutralize the effects and return to the "default settings." In addition to the basic concept of "opposing movement," we can utilize targeted exercises in order to assist the desired restoration effects. Most of these techniques are familiar to all of us and follow the flexibility continuum, starting from the myofascial release and static stretches leading up to more dynamic and integrated movements. By including motor components from mobility to power in the progression, the neural input becomes more complete.

The most opportune time to utilize these exercises is pre and post cycling. The exercises can be used within the active warm up or cool down or both. By activating the proper sequence of muscle recruitment prior to the cycling itself, we are not only giving the athlete a better protection against the injuries but a potential for higher performance as well. On the other hand, immediately after the ride, we have the most effective window of preventing those acute soft tissue adaptations from turning into chronic ones.

Overall, the use for these reverse exercises is more preventive by nature. If the imbalances have lead to chronic structural/muscular changes, a more specific and individualized "corrective" approach by a specialist might be required.

Here is an example of two potential problem adaptations that relate to cycling and a sample exercise progression to be included either in the movement preparation sequence or the post cycling cool down.

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Flexibility/Mobility  Stability/Activation  Strength/Power

| CYCLING | REVERSE EXERCISE PROGRESSION (examples) | | | |
|---|---|---|---|---|
| THORACIC ROTATION LIMITED |  |  |  |  |
| | A) Self-myofascial release thoracic spine and lats | B) Pec/shoulder stretch with a stick in a split stance | C) Cable rotation in a split stance | D) Rotational medicine ball toss |
| HIP EXTENSION LIMITED |  |  |  |  |
| | A) Self-myofascial release hip flexor and quad | B) Hip flexor/quad stretch in a lunge stance | C) Hip extension against resistance (i.e., bungee, band) | D) Single leg deadlift with a dumbbell (full flexion and extension) |

**"From Pedaling to Pounding"**

"After pushing and pulling the pedals in a flexed position for a long time, running seems like a sick joke at first. During the first strides, the glutes don't fire, the quads hate the ground contact, and the spine doesn't remember how to extend and rotate."

A research study on "Acute Effects of Cycling on Running Step Length and Step Frequency" found, not surprisingly, that running form and movement is altered by the preceding cycling performance. The stride length in running right after cycling was shorter, and the stride frequency was higher. Reasons for this could be many, from general fatigue to motor program confusion and acute soft tissue changes. Whatever the reason, switching from running to cycling requires training of the transition itself as well as maintenance of the most optimal force production mechanics.

So, we know that cycling doesn't exactly prime you for running the best way. Switching from a non-contact cyclical pattern into running that suddenly requires "plyometric" deceleration capabilities from the muscles is shocking in many ways. However, an athlete whose body is not chronically imbalanced or stuck in the "mold" can switch between movement patterns without a motor meltdown or an injury.

The physiological adaptations stimulated by cycling can not be ignored when designing a training and conditioning program for a triathlete. Prior to progressing within the performance continuum, the fundamental movement abilities need to be restored. This not only functions as a foundation for all the other training adaptations but also as a method of recovery and regeneration.

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