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Making a Case for Strength Training for Cyclists: a Practical View from a Cycling Coach-Part 2 Leg Exercises

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Last issue we looked at the reasons why strength training is important for cycling and the muscles involved. This issue we'll look at leg exercises and putting it into a plan.

The Exercises

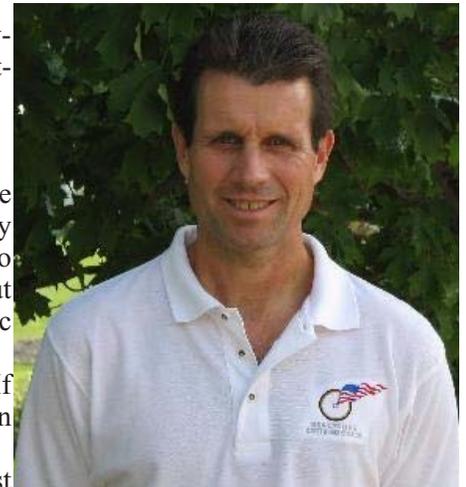
The **squat** works the quads and glutes. These are the powerhouses of the pedal stroke and can handle heavy loading. The squat involves both knee and hip extension simultaneously as you stand up out of a squat. Therefore it strengthens both muscle groups in proportion to each other – the quads will be as strong as they need to be relative to the glutes. Coming out of the squat position mimics the downward pedal stroke motion making it a movement specific exercise for cyclists.

The **leg curl** works the hamstring muscles, those used to pull back on the pedal. If you just do squats, you ignore and potentially will have relatively weaker hamstrings than quads and glutes.

A good way to hit the hip flexor muscles is to do **one legged pedaling**. When you first start pedaling with only one leg (clipped into your pedal of course while the other is held out of the way), it won't take long before your pedal stroke becomes jerky and you have trouble getting your leg back up on the upstroke. This is because of weak hip flexors. When riding two-legged, we get lazy and let the downward leg push the upward leg back up. One legged pedaling does two important things: it strengthens the hip flexors and it also provides neuromuscular training so this pulling up motion becomes more automatic when pedaling with two legs. You don't want to have to consciously think about pulling up with every pedal stroke. These three exercises (squats, leg curls, one legged pedaling) will hit the four major muscle groups involved in the pedal stroke.

Strength-Endurance Training

When pedaling along at your anaerobic threshold or time trial pace, you are only using a fraction of your absolute leg strength with each pedal stroke. When a body builder or weight lifter refers to "strength endurance", they typically are referring to 15 reps of a given exercise. However, you are doing many thousand reps per ride. Our definition of strength-endurance is a little different – a lot more endurance and less strength required. When a weight lifter is doing 15 reps of a given exercise, he can lift approximately 65% of his one rep maximum lift. So you can imagine that a cyclist doing a time trial doing thousands of reps is using an even lower fraction of his total leg strength. I can hit 800-1000 watts for a few pedals strokes but my threshold is less than 1/3 of that amount. So cycling at a fairly fast pace requires only a relatively small fraction of overall strength. This is a reason some coaches give that strength training isn't necessary for cyclists – cyclists don't need a huge amount of strength when cruising along. However, it's also been said that a stronger muscle are less susceptible to fatigue. Let's say you can crank out 1200 watts briefly while another cyclist can only hit 1000 watts. Let's say you both have a threshold power of 300 watts. You will be using a lower percentage of your muscle strength than the other cyclist when both of you are riding at threshold your muscles function more efficiently fatiguing less.



David Ertl

Strength-endurance is effectively trained by riding a bike at or near your threshold level. In order to use the strength you have, you must be able to support aerobic muscular force by supplying oxygen and fuel to the working muscles, cardiovascular fitness. If your cardio system isn't able to keep up, then it doesn't matter how strong your legs are. I've been dropped in races doing 180 watts, much lower than my threshold, but when I am exhausted, I can no longer generate the force I could when fresh because of cardiovascular fitness, not because my muscles are not strong. So on-the-bike threshold work is very important, but the other half of the equation is having the strength to use assuming your cardio system is able to support it.

Improving your strength-endurance requires fairly high reps with moderate weights. I like to prescribe 20-50 reps per set of exercises when working on strength-endurance. This sounds huge to a typical weight lifter, but when you consider you normally do thousands of reps, 50 isn't that many, but the force required for each rep is considerably higher than pedaling a bike, even uphill. I like to think of this type of training as mimicking hill work. Your leg speed is somewhat reduced, you are generating a lot of force and you may do a couple hundred reps (pedal strokes) going up a hill. At the beginning of the leg strength phase of training, you want to ease into it; otherwise your legs will be extremely sore. So start off strength-endurance training with very light weight. The first time I do squats in the fall, I just use the bar. I will do 2-3 sets of 15 reps. It's amazing how sore you may feel that the next day! Once over the initial shock, your muscles will respond quickly and you will be able to increase the weight quite fast. Work your way up to 5 sets of 20-50 reps of each exercise. The exercises I suggest training this way are the squat and leg curl. You should also do one legged pedaling to improve strength-endurance of the hip flexors. Start out trying to make it one minute with each leg and build up to two minutes. Do at least three sets of one legged pedaling per session. Use the highest gear you can while still pedaling a smooth circle. This is actually a good exercise to do during your warm-up.

A word about squats: If you do traditional back squats where you rest the barbell on your shoulders and then drop your hips towards the floor, you as a cyclist should try to go low enough so that your thighs are parallel to the floor. Some trainers suggest doing half squats, where you only go down to the point where your knee angle is 90 degrees. This is recommended for safety and for people who may have injured knees. As a cyclist, your knee is bent considerably more than 90 degrees at the 11 o'clock position. Just hop on your bike and look at your knee angle at the top of the pedal stroke. You want to mimic that with squats, (unless of course you have knee problems), then you are better off stopping at the half squat.

Max Leg Strength Training: To improve your absolute strength, which is what weight or power lifters typically do, you need to lift heavy weights. In order to do so, you need to reduce the reps you can lift. Also, because heavy weights are involved, you need to be very careful not to injure yourself. So some modifications are in order. To build strength most effectively, you need to lift a weight that is heavy enough to prevent you from being able to lift more than 6- 8 reps at a time. The last rep should be very difficult to complete. We will work on the quads, glutes and hamstrings this way, but not the hip flexors. They will continue to get worked just doing one legged pedaling.

Chain Link: To learn to squat safely click [HERE](#). For the hamstrings, you can continue using the leg curl machine you've been using for strength-endurance, just increase the weight and decrease the reps. These can also be done one leg at a time. Don't start doing heavy strength work until you've had a good base of strength-endurance, to give your leg muscles a chance to get stronger and to get used to strength training.

Leg Speed-Strength Training: As mentioned above, you need to not only have strong muscles, but they must be trained to fire quickly. Strength training increases muscle strength and power because power is equal to strength x speed. But speed also need it's own specific work. So to work on rapid firing, we will incorporate some jumping exercises. This is not to be confused with plyometrics. I do not advocate plyometrics for cyclists. Plyometrics are a jumping exercise which begins by pre-stretching the muscles and then exploding into a jump, for example, jumping off a box and then back up in one quick motion. As you jump down, you do an eccentric stretch of the glutes and quads and then as you explode back up, they contract from this stretched condition. This type of exercise is used for ground-based sports such as football and basketball, where the players stop suddenly and jump or change direction. The pre-stretch is helpful to these athletes because a stretched muscle has elasticity which helps spring the muscle back as it is contracting. You can jump higher if you quickly drop into a squat and back up than if you just start from a dead standstill. However, in cycling there is no pre-stretch at the top of the pedal stroke so there is no elastic potential energy stored up in the muscles that we can take advantage of. So, for our jumping we will start each jump for a standstill. The other reason I don't like plyometrics is because the risk of injury is so high. Even if supervised, it is very possible to twist an ankle, strain a joint or pull a muscle. It's not worth getting injured during strength training, especially a muscle or joint injury as these take a long time to recover from.

The main jumping exercise will be the squat jump. This involves starting in a squat position and then jumping as high as you can. I find it helpful to have a step or box to jump up onto – it gives you something to aim at. But if you don't have anything available, you can simply jump as high in the air as you can. As you land, lower yourself back down into a squat position and stop momentarily before jumping again. The key is to jump from a deep squat position, similar to the joint angles when your pedal.

Chain Link: Click [HERE](#) for how to do a jump squat.

Typically squat jumps are taught with throwing your arms overhead. That just creates artificial momentum. You want your legs and hips to do all the work so keep your hands on your hips as you jump. You don't throw your hands in the air while riding, do you? (except when you cross the finish line first! True story: I actually saw a guy throw his hands in the air so forcefully at the end of a race that he threw himself right off his bike backwards. To make matters worse, he was second and didn't realize the winner had already crossed the line. Oops!).

The amount of power you generate while jumping is much higher than the power you generate doing squats or leg presses

with weights. That's because power is a function of both strength and speed. Because you are contracting the muscles so much faster when jumping, you are creating a lot more power. Keep in mind that you are still lifting your entire body weight, so just because you don't have a barbell on your shoulders, it's not like you are not lifting any weight.

Periodization of leg strength training: There is a timing element to leg strength training. Some coaches go to great detail to create a week by week periodized leg strength training plan. I prefer to keep it as simple as possible. However, there is an order in which you should do strength training. Begin at the end of your transition period, typically in October for a road cyclist. Start by doing squats, jump squats and leg curls with very light weights and increase the weight and reps as you get over your initial muscle soreness, which should only last a few days if you aren't too aggressive. Once you've had a good full month to six weeks of training with high reps (strength-endurance), such as mid to late November, you can start adding in max strength workouts. Again, work your way up to your maximum lifting weight. Don't try to do it first time you do this workout. Do both strength endurance and max strength workouts concurrently (each workout once each week) through February. Once you get to March, you are hopefully doing more riding outdoors. Strength training is hard on the legs and takes its toll on muscles. You will notice that you don't have as much energy or pep if you try to do a hard ride the day after a strength workout. So as the weather starts to improve, phase out the max strength work. Continue to do the strength-endurance work but start to back off the weight and do the motions more quickly to transition the muscles into a faster, more powerful action suitable for riding.

Continue to do one-legged training year round, at least once a week during the riding season just so you don't lose that muscle memory. Do them twice a week during the off-season. For squat jumps, you can do those starting in October and running through March.

Sample Plan: Here is a layout of a generic leg strength training plan by month.

October: Single leg pedaling, squat jumps, low weight, moderate rep strength endurance squats and leg curls

November: Single leg pedaling, squat jumps, moderate weight and high rep strength endurance squats/leg curls

December thru February: Single leg pedaling, squat jumps, moderate weight strength endurance squats/leg curls alternated with high weight max strength leg presses and leg curls

March: Single leg pedaling, squat jumps, high speed lower weight squats and leg curls

April – September: Single leg pedaling, on-bike leg strength workouts (low gear climbs, seated grinds, etc).

Here's what a single leg pedaling workout might look like: warm up. Pedal with right leg for one – two minutes. Switch to left leg. Spin easily with both legs for two minutes. Repeat for a total of 3 sets.

Here's what a squat jump routine might look like: Warm up on a stationary bike. Do a series of 20 squat jumps. Rest (or do a different exercise). Then do 4 more sets.

Here's what a strength endurance routine might look like: Warm up on a stationary bike. Do a set of 50 squats. Then do a set of 50 leg curls. Repeat until you've done 5 sets of both exercises.

Here's what a max strength routine might look like: Warm up on a stationary bike. Do a set of 7 reps squats, then do a set of 7 reps leg curls. Repeat until you've done 5 sets of both exercises.

On days when you are doing strength endurance, here's how you might set it up. Warm up on a stationary bike. Do a set of squats, then leg curls, then squat jumps, and finish up with a set of single leg pedaling. If you are at a gym, you can do single leg pedaling very effectively on a spin bike so hopefully you can hop on one easily between your strength sets. Go back through this routine 4 more times, or whatever is called for in your training plan.

On days when you are doing max strength, here's how you might set it up. Warm up on a stationary bike. Do a set of squats, then leg curls, then squat jumps, and finish up with a set of single leg pedaling. Go back through this routine 4 more times, or whatever is called for in your training plan.

Supplemental leg and hip strength exercises: Cycling is quite one dimensional. We pedal in one plane and push and pull with the legs and hips. Never do we move our legs side to side or fully extend the hip. These motions become underdeveloped and may lead to muscle imbalances. It's a good idea to incorporate a few of these exercises to help maintain some balance during the off-season.

Hip adductors: Hip adduction is the pulling of the leg in towards the center of the body. A little adduction occurs in the pedal stroke as you work to keep your knee in towards the top tube, but not much. The hip adductor muscles can be strengthened with specific hip adduction machines (where you squeeze your knees together against resistance) and it can be easily done with exercise bands or a cable machine. **Chain Link:** Click [HERE](#) for a hip adduction abduction exercise.

Hip abductors: Hip abduction is when you pull your leg out to the side, away from the body. Similar to hip adduction, these can be strengthened with specific hip abduction machines, where you push your knees out away from each other against resistance, and with bands or a cable machine.

Full hip extension: While cyclists do hip extension during the pedal down stroke, it is only a partial extension. We rarely fully extend our hip, even outside of cycling. If you have done cross-country skiing, you will notice that your lower back and hip get tired quickly. While skiing, we bring our leg back as far as it will go while pushing off on the ski. In cycling, most of the hip flexion is due to the glutes working. When doing a full hip extension, it more fully engages the glutes and other muscles (hamstrings). This

motion is best worked using bands or a cable machine. Attach to your ankle and pull the leg back, keeping the knee straight, keeping the hips stationary. Do both legs.

Putting it all together – creating a powerful, smooth pedal stroke

Leg strength is critically important for cycling, but it is also important to use this strength in a manner that creates a smooth and efficient pedal stroke. Here are some ideas for turning the pedals in a smooth fashion. You may have noticed that the knee is maximally flexed at the 11 o'clock position instead of the 12 o'clock position. This means your knee starts to extend as the foot comes over the top of the pedal stroke. Therefore, you should be thinking about pushing the foot forward as it crosses over the top of the pedal stroke, which engages the quad muscles. Start by pushing at the 11 o'clock position instead of 12 or 1 o'clock this results in a smoother, less choppy pedal stroke. Try this sometime when riding, especially uphill or into a headwind. You will notice a difference. It's like your leg gets a head start on the down stroke and it helps smooth out the dead spot at the top and bottom of the pedal stroke.

As your foot goes down through the down stroke, you are engaging both the quads and glutes. You really don't have to think about this, it comes naturally. But keep in mind that the most force is generated at the 3 o'clock position, as the force is perpendicular to the crank arm. However, as you get down to 5 and 6 o'clock, you are pushing mostly parallel to the crank arm and very little force is being used to turn the crank. So don't continue mashing down on the pedals once it reaches the 5 o'clock position. You are just wasting effort. Once the pedal reaches 5 o'clock, instead you should be thinking "pull back" on the pedals. The objective is to try to put a force on the pedals in such a way that the force is always as perpendicular to the crank arm as possible throughout the pedal stroke. So at the bottom of the stroke, where the crank arm is vertical, you need to be pulling back on it to create useful force on the cranks which translate into forward motion of the bike. To pull back, you engage your hamstrings. It is commonly stated that you should be envisioning scraping mud off the bottom of your shoe as you are pulling back through the bottom of the pedal stroke. This helps visualize the feeling in your hamstrings.

Some people recommend breaking the pedal stroke into three parts: 12 o'clock to 5 o'clock, 5 o'clock to 8 o'clock and 8 o'clock to 12. We've just covered the first two parts, the pushing down and pulling back. The third part is pulling up from 8 to 12. This engages the hip flexor muscles. However, I don't advocate breaking the pedal stroke into three parts, for a couple of reasons. First, it's more complicated. Your legs are flying around at 90+ rpm and your brain really doesn't have time to think push-pull- lift, push-pull-lift, with both legs at the same time. I find doing so, especially the lifting or pulling up phase, actually makes my pedal stroke choppier. Plus, as mentioned above, the hip flexors are pretty weak and don't really contribute much to forward motion so accentuating this motion doesn't really help power the bike forward. So instead, I recommend just thinking „push-pull". Push from 11 o'clock to 5 o'clock, and pull from 5 back up to 11. By pulling back on the pedal, you will actually be flexing the hip and pulling up and lifting as the pedal comes up through the backstroke without even thinking "lift". If you have been doing one-legged pedaling religiously, your hip flexors will be trained to fire as you are pulling back and up. Also, you will be able to think fast enough to think "push-pull" during pedal strokes with both feet. Give it a try the next time you are out riding. I bet you find you pick up a little speed plus you should notice a smoother pedal stroke, especially if you start pushing at 11 o'clock and start pulling at 5. O

More Information Please!

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