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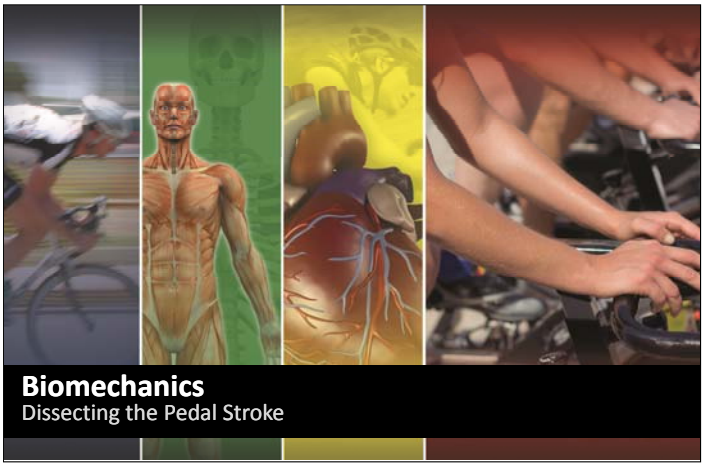

Biomechanics
Dissecting the Pedal Stroke

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Agenda

- The Pedal Stroke
- Speed / Power Ride
- Q&A

BIOMECHANICS | DISSECTING THE PEDAL STROKE

The Pedal Stroke
Muscles and Technique

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BIOMECHANICS | DISSECTING THE PEDAL STROKE

Ankling

- The foot should be a “firm” but **not** a “stiff” lever
- A natural ankling movement

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BIOMECHANICS | DISSECTING THE PEDAL STROKE

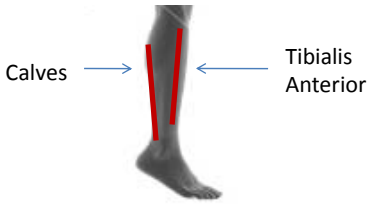
Reciprocal Inhibition

- Reciprocal Inhibition occurs when both an agonist and antagonist muscle (group) contract simultaneously
- The body has a build-in neurologic safety mechanism which will hinder mechanics
  - Scenario 1: Attempting to stop ankling movement (stiff foot)
  - Scenario 2: Forcing the heels down
  - Scenario 3: Pointing the toes down
- Which muscles are being activated?

BIOMECHANICS | DISSECTING THE PEDAL STROKE

Reciprocal Inhibition (Cont.)

- Both the calves and tibialis anterior contract, fighting each other
- The gastrocnemius crosses the back of the knee joint. When contracted (voluntarily), hinders the movement (speed) of the leg.



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BIOMECHANICS | DISSECTING THE PEDAL STROKE

The Upstroke

- The Upstroke engages the hip flexors (Iliacus, Psoas Major and Minor, Rectus Femoris)
- The Rectus Femoris is both a hip flexor and knee extensor because it crosses both the hip and knee joints.

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BIOMECHANICS | DISSECTING THE PEDAL STROKE

Top of the Stroke?

- The top of the stroke is more a transition from upstroke to down stroke
- Hip Flexors handing off to the Glutes
- Glutes handing off to the Quads

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BIOMECHANICS | DISSECTING THE PEDAL STROKE

The Downstroke

- The downstroke starts with the Glutes firing at the top (extending the hips)
- The Hamstrings (hip extensors) to not have a mechanical advantage at Top Dead Center (12 o'clock)
- The Quads (leg extension) do not have a mechanical advantage at 12 o'clock
- If the upstroke is not emphasized (and trained) Glute engagement is hindered
- Think of this as pulling the hammer back on a gun which loads (stretches) the Glute muscle fibers.

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BIOMECHANICS | DISSECTING THE PEDAL STROKE

The Downstroke

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BIOMECHANICS | DISSECTING THE PEDAL STROKE

The Bottom of the Stoke

- Pulling back at the bottom of the stroke engages the hamstrings, and to a lessor extent, the calves (stabilizers)
- Transition from the downstroke to the upstroke

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BIOMECHANICS | DISSECTING THE PEDAL STROKE

Misconception / Confusion

"EFFICIENCY'
Theory: There is no difference in the metabolic cost of either only pushing down on the pedals (piston-style) or circular pedaling.

From what we know: Yes, sort of…

Thought: Regardless of whether one uses 100% of 1 muscle groups or 50%-30%-20% of 3 muscle groups, the total is still 100%

Additionally: Metabolic cost has not currently considered the mechanical cost / muscle fatigue

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BIOMECHANICS | DISSECTING THE PEDAL STROKE

Misconception / Confusion

"CIRCULAR PEDAL STROKE'
Theory: Pedaling circles means one is using all of the muscles equally

NO. The size and strength of the muscles varies greatly. The strength of the hip flexors (upstroke) generally does not equal the strength of the quadriceps (downstroke)

A smooth pedal stroke indicates that muscles are contributing to a smooth "transition" (maintaining velocity) between muscle groups.

BIOMECHANICS | DISSECTING THE PEDAL STROKE

Misconception / Confusion

"Piston or Circular Pedaling?"
Theory: Based on the previous slide, pulling up is futile since we just said the hamstrings can't apply the same force as the quads. The best we can do is "un-weight" the back foot so as not to fight the quads.

INSERT "GRAVITY"
Wait a minute, we said "un-weight". How do you do that? We LIFT the leg.

Also, we don't begin pulling up at 6 o'clock (which is how many people explain it), we pull up closer to 10 o'clock after the quads have exceeded their mechanical advantage.

These "lifting" and "pulling-up" muscles (hip flexors) need to be conditioned, hence the need for drills that focus on pedal stroke.

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Let's Ride!

Experience the Muscles at Work

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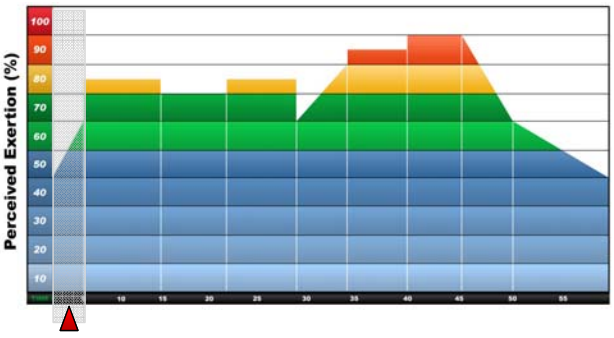
Experience the Muscles at Work

Speed to Power Ride



Warm-Up 1

PE: ~50-60%
RPM: 90
Time: 5:40

Light, noticeable progressive resistance. Review safety, hand positions, proper form, how to gauge intensity (PE). Overview of the workout / training.

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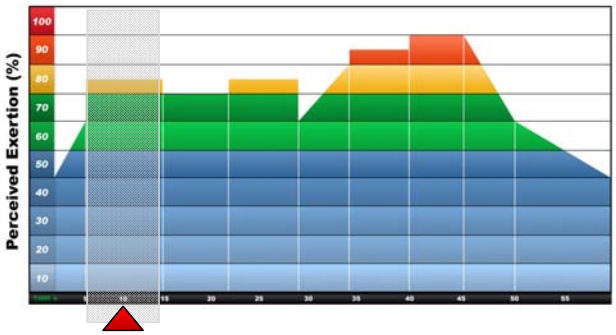
BIOMECHANICS | DISSECTING THE PEDAL STROKE

Experience the Muscles at Work

Speed to Power Ride



Warm-Up 2 | Spin-Ups

PE: ~75%
RPM: 85
Time: 9:30

Moderate resistance (enough to stand safely).
Short 10-second accelerations in and out of the saddle. Stay in control and bring legs to top speed. Recovery for ~20 seconds between accelerations.

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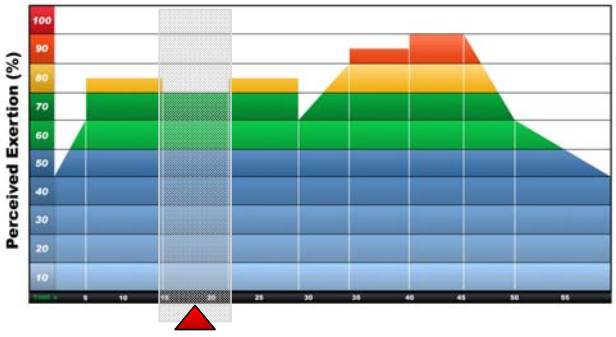
BIOMECHANICS | DISSECTING THE PEDAL STROKE

Experience the Muscles at Work

Speed to Power Ride



Biomechanics | Connecting Mind to Muscle

PE: ~70%
RPM: 65
Time: 7:00

Add enough resistance to slow and overload legs. Spend time focusing on each part of the pedal stroke. Relax the upper body and the feet. (In and Out of the saddle)

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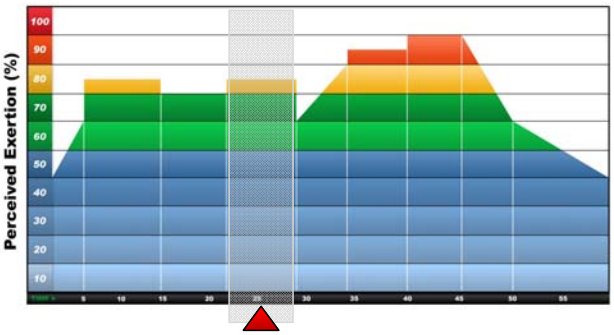
BIOMECHANICS | DISSECTING THE PEDAL STROKE

Experience the Muscles at Work

Speed to Power Ride



Speed Drills | 1-Minute Intervals

PE: ~75%
RPM: 60 - 120
Time: 7:00

Moderate Resistance. Perform 1-minute speed intervals with 30-second recovery between each. Focus on different parts of the pedal stroke separately.

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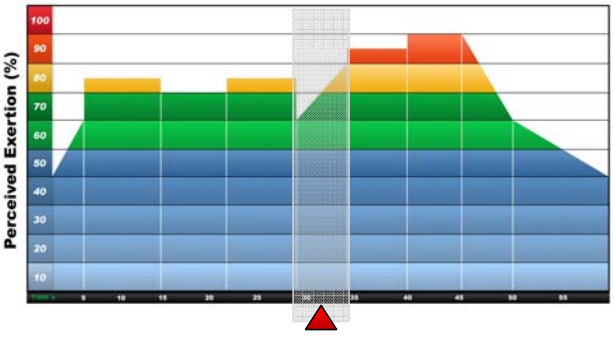
Speed to Power Ride



Climb | Prepare the Muscles for Power

PE: ~60 - 85%
RPM: 70
Time: 4:00

Steady climb starting at a easy resistance (enough to stand). Alternate in and out of the saddle each minute. Add resistance each minute. No sprinting or attacks – steady!

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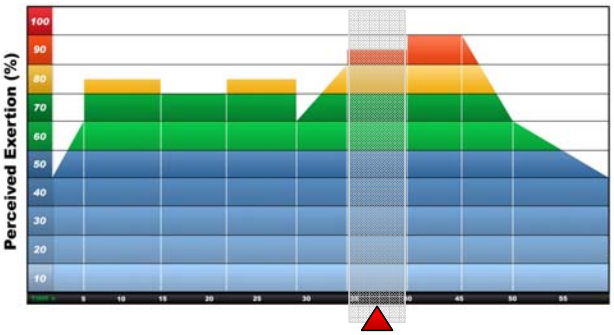
Speed to Power Ride



Speed Drills | Loaded Accelerations

PE: ~60 - 85%
RPM: 60 - 120
Time: 6:30

Start on an easy noticeable road. Count down and have riders load on heavy resistance. Accelerate for 30 seconds. Recover at an easy resistance for 30 seconds.

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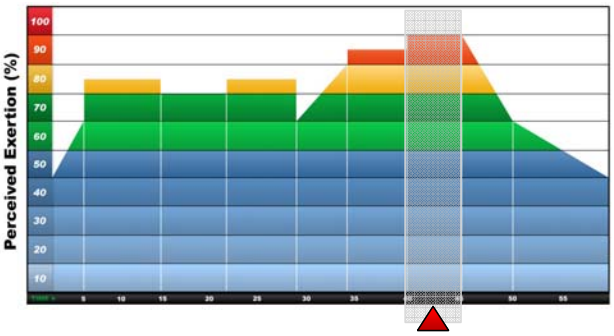
Speed to Power Ride



Power Development | Resistance Loading

PE: ~70 - 90%
RPM: 100
Time: 5:30

Find and maintain the cadence of 100 RPM. Start on an easy flat road and begin adding small amounts of resistance every 30 to 15 seconds. Leg speed must not change.

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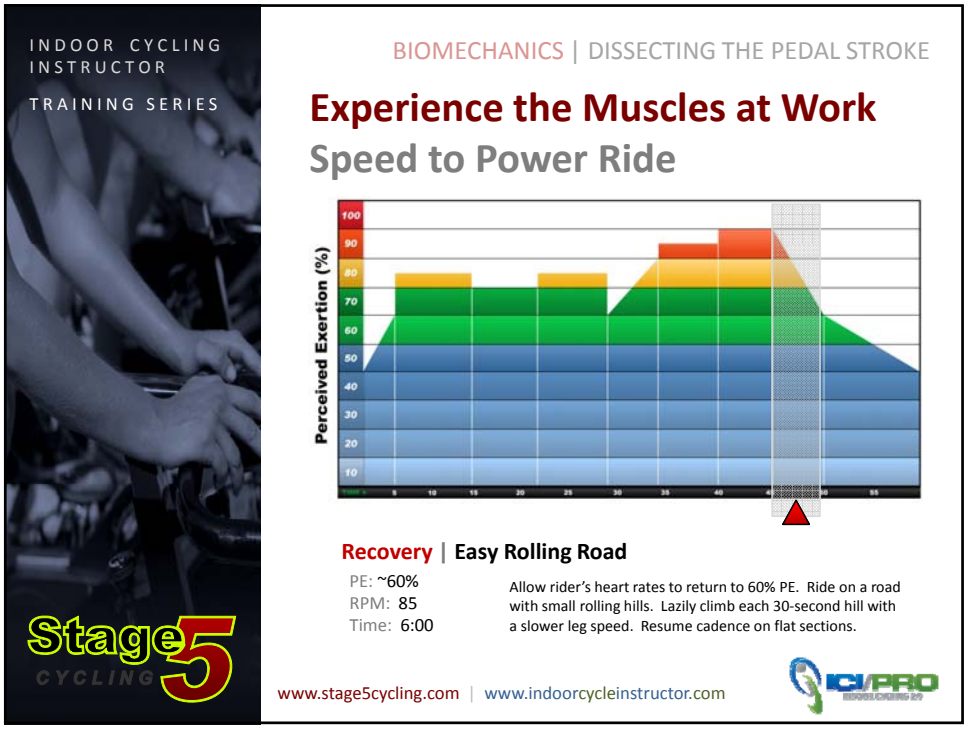
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Speed to Power Ride
Perceived Exertion (%)
100
90
80
70
60
50
40
30
20
10
Recovery | Easy Rolling Road
PE: ~60%
RPM: 85
Time: 6:00
Allow rider's heart rates to return to 60% PE. Ride on a road with small rolling hills. Lazily climb each 30-second hill with a slower leg speed. Resume cadence on flat sections.
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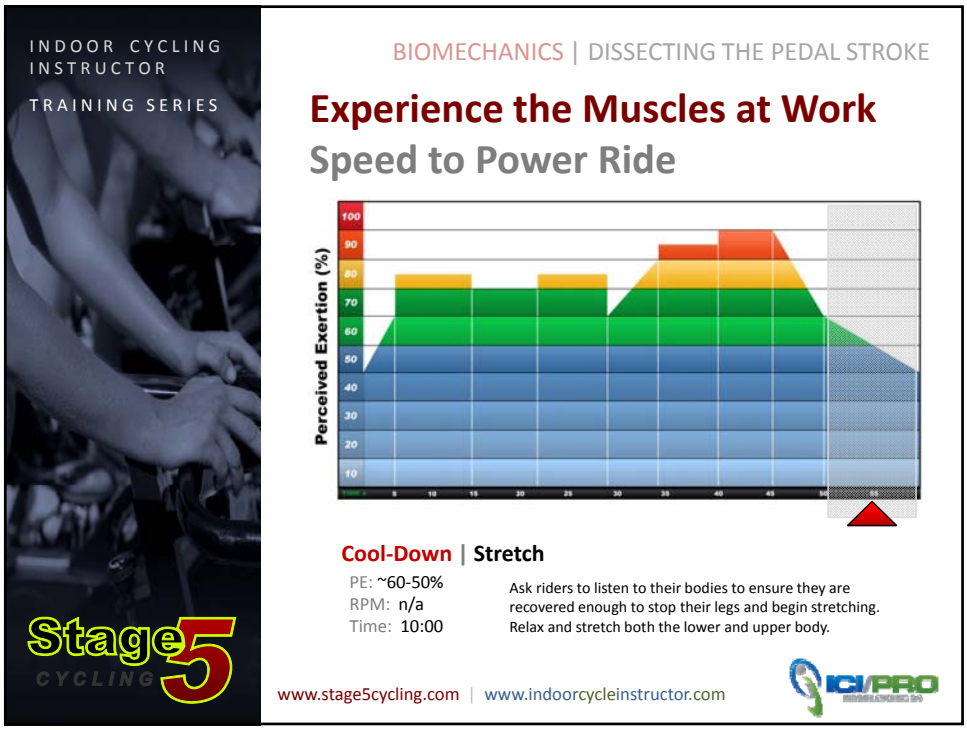
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Speed to Power Ride
Perceived Exertion (%)
100
90
80
70
60
50
40
30
20
10
Cool-Down | Stretch
PE: ~60-50%
RPM: n/a
Time: 10:00
Ask riders to listen to their bodies to ensure they are recovered enough to stop their legs and begin stretching. Relax and stretch both the lower and upper body.
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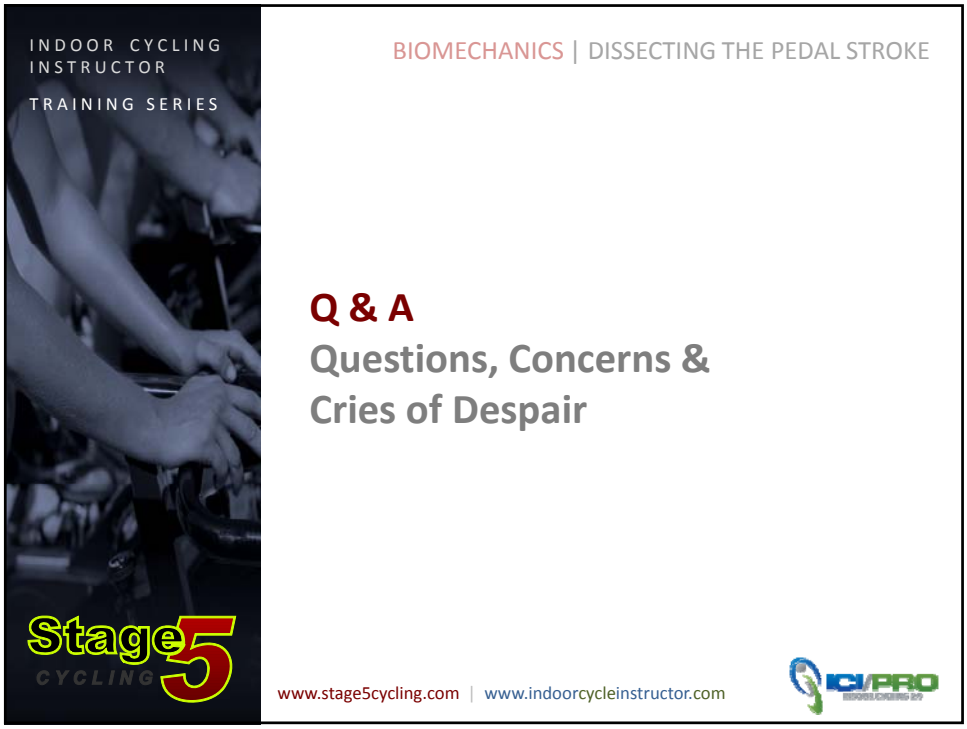
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