

ROTOR STUDY

This study contains the results of a scientific analysis of the same athlete completing the same journey of 30 kilometers approximately every two days, always repeated at the same hour. For the first three months, this athlete practiced with a conventional pedal system, followed by the same tests using the ROTOR system.

They have recorded the times of each time trial, average heart rate and the percentage in which the calculated anaerobic threshold has been passed in the effort test.

They have grouped together the journeys of the same times, and after being analyzed, they have recorded the value of the average heart rates. This is completed with a conventional pedal system and with the ROTOR system in separate charts.

TABLE OF TIMES AND HEART RATES WITH TRADITIONAL PEDAL SYSTEM

DURATION	AVERAGE PULSE	%>ANAEROBIC THRESHOLD
67 MIN	124/MIN	1,7%
66 MIN	128/MIN	2,31%
65 MIN	123/MIN	0,8%
64 MIN	129/MIN	4%
63 MIN	132/MIN	2,3%
62 MIN	133/MIN	2,4%
61 MIN	130/MIN	3,9%
60 MIN	133/MIN	5,6%
59 MIN	142/MIN	13%
58 MIN	135/MIN	7%
57 MIN	145/MIN	12%

TABLE OF TIMES AND THRESHOLD WITH THE ROTOR SYSTEM IN POSITION 3

DURATION	AVERAGE PULSE	%>TO ANAEROBIC THRESHOLD
65 MIN	115/MIN	0%
62 MIN	107/MIN	0%
61 MIN	128/MIN	7%
60 MIN	129/MIN	2,9%
59 MIN	121/MIN	0,4%
58 MIN	126/MIN	3,7%
57 MIN	127/MIN	3%
56 MIN	129/MIN	4,6%
54 MIN	130/MIN	11,9%
53 MIN	131/MIN	11%
52 MIN	131/MIN	6,7%

CONCLUSIONS:

1. BETTER TIMES WERE ACHIEVED WITH THE ROTOR SYSTEM IN THE SAME DISTANCE
2. EQUAL TIMES WERE ACCOMPLISHED WITH LOWER AVERAGE THRESHOLD

3. IN EQUAL TIMES THE ANAEROBIC THRESHOLD WAS SURPASSED WITH LESS FREQUENCY. THERE IS LESS ANAEROBIC WORK IN WHICHEVER EXIT, FOLLOWED BY A SMALLER PRODUCTION OF LACTIC ACIDS AND TOXINS, WHICH IS AN ADVANTAGE TO BETTER HEALTH OF MUSCULAR GROUPS.

4. THE JOURNEY PRESENTS THREE STRONG SLOPES IN THAT WHICH THE SAME DEVELOPMENT HAS BEEN MAINTAINED AS MUCH AS WITH ONE SYSTEM AS WITH THE OTHER, INCLUDING THE POSSIBILITY OF AN INCREASE IN REVOLUTIONS PER MINUTE WITH THE ROTOR SYSTEM

5. AN INCREASED COMFORT APPEARS WITH THE ROTOR SYSTEM WHEN PEDALING WHILE SITTING FOR A LONGER PERIOD OF TIME, IT IS TO SAY THAT IT DOES NOT "ASK" THE RIDER TO STAND WHILE ON THE MACHINE AS SOON AS THE CONVENTIONAL PEDAL SYSTEM.

REDUCTION OF AVERAGE THRESHOLD WITH USE OF THE ROTOR SYSTEM AND DECREASED PERCENTAGE IN TRIALS THAT EXCEEDED THE ANAEROBIC THRESHOLD

TIME	REDUCTION OF HEART RATE	%REDUCTION OF ANAEROBIC THRESHOLD
57 MIN	18/MIN	9%
58 MIN	9/MIN	3,3%
59 MIN	21/MIN	12,6%
60 MIN	4/MIN	2,9%
61 MIN	2/MIN	2,4%
65 MIN	8/MIN	0,8%

INCREASE IN OBTAINED SPEED WITH THE SAME HEART RATE

WITH 131/MIN WITH THE ROTOR SYSTEM 34.28 KM/H WAS ACHIEVED DURING 52-53 MIN WHICH IMPLIES 9% ABOVE THE THRESHOLD.

WITH 131/MIN WITH THE TRADITIONAL PEDAL SYSTEM 30 KM/H WAS ACHIEVED DURING 60-61 MIN WHICH IMPLIES 5% ABOVE THE THRESHOLD

TO ATTAIN 31. 6 KM/H WITH THE TRADITIONAL PEDAL SYSTEM 12% ANAEROBIC IS MADE WITH 127/MIN WITH THE ROTOR SYSTEM THE SAME SPEED WAS ATTAINED BUT WITH EXCLUSIVELY 3% ANAEROBIC

MUSCULAR CONDITIONING

This study was realized after the training of 4,000 km with the traditional system and after a period of 10 days of rest, due to an injury, the ROTOR system was used. In the hard trainings and in the first competitions it is true that "muscle stiffness" appeared that was eased and disappeared with stretching, the salidas continued in bicycles and some physiotherapy sessions. The feel in competition is good, you do not feel strange nor weird while pedaling.

The new ROTOR system has five positions for the pedal so that you can begin to change in a progressive form. We decided to begin this study in position 3. During the next 30 days we went ahead to use position 2 and then returned to make a comparison study, finally completing the study with position 1, and that is when the pedals presented their best annulment of the dead spots.

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**TRAINING PROGRAM TO FAMILIARIZE ONESELF WITH THE ROTOR SYSTEM FOR THE FIRST TIME.
(By Dr. Joseba Barron Arniches. Competitive cyclist and Specialist in Sports Medicine)**

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1.- Initiation

This is the most fragile time when changing a pedaling system. This step will almost always be noticed due to the memory's tendency to store joint movements, regarding physical activities, that one is able to do. The experienced cyclist is able to detect a difference of a millimeter in the seat, the handlebars, or the backward movement of the heel in the shoe, etc., for the cyclist of the Rotor system, the greatest shock is "the coordination of movement of the joints and lower extremities." **It does not employ different muscles**, as you might have heard in the cycling world, but when your hip is flexed at 120° with the foot in the lowest point of the pedal cycle it waits for the other hip to be at 90° corresponding to the highest point of the pedal cycle, but this does not occur with the Rotor, instead this foot has passed the highest point of the pedal cycle and the hip has begun its descent in the pedal cycle from 90° to 95°.

The same occurs with the knees' neurological organisms responsible for giving the exact position that our joints have in every moment. When the right foot is the lowest point, there is an amplitude of 150°, the left knee waits for the right to present a maximum flexion around 75°, but the right foot has already passed this point and has begun its descent towards 80°, allowing the quadriceps muscular group begin to work.

In conclusion: **The new Rotor system alters the actual neuromuscular coordination of the lower extremities.**

This alteration powerfully calls the attention when pedaling for the first time. I would define it as producing an "amusing swinging motion towards the front and back of the seat."

My advice is to begin the transition at a **calm period of the season**. For example, after a halt for an injury, after a period of rest at the beginning of a season, or well into the season, but with a change of regular plans, it is to say that one should relearn the movements, and this is to be completed slowly and with care.

2.- ADAPTATION

1st week. Begin with one hour rides, on flat terrain, alternating days of **development without driving yourself crazy with the cadence.**

If read correctly, no hills, just as we recommend to all cyclists trainers. When employing the new system a beginner will repeat a first error until terrible, repetitive sensations of swinging produce irritations in the perineal zone. It is necessary to relearn the movements, to understand the new situation of neuromuscular coordination, completing the period of familiarization with patience, ensuring improvement.

2nd week. Equal to the 1st, but on steep slopes, requiring standing on toe while on the bike. Strongly hold on to the lowest part of the handlebars.

3rd week. Increase the rides to one-and-a-half hours and use a chain ring with little cadence. **LET THE SHOW BEGIN!** The sensation of resistance that is recalled from the same slope, disappears; the introduction of the knee in each pedal with the posture of "dancing on the bike" is delicate and painless, there is no

aggressiveness; strength increases with each effort, you do not bounce against yourself, your back or knee, you sink into the pedal. Pure glory.

4th week. **Begin passes with maximum cadence**. You are already accustomed to the new system, now it is time to test the advantages and for this there is nothing better than climbs. Do a warm up of 30 to 60 minutes (the longer the better) in levels 1 and 2 according to each levels' anaerobic limit obtained through the effort test. You arrive at a pass where you habitually climb in a 39*19 standing on toe position and instead begin the pass in a 39*25 position while seated. One must realize that cadence is not lost by using the Rotor. There are not any problems in the roundness of the pedal; it is likely you will not even notice any changes except for the difference in angles.

Make 2 passes of about 10 minutes each and complete with an hour of smooth pedaling. Afterwards complete the required stretching and spend an hour with the physiotherapist for a checkup on old muscular pains or injuries. This is the first of three, 3 hour rides with 20 minutes of maximum effort, and you can feel it. Continue riding on alternate days but reduce the intensity to only one hour with a smooth pedaling cadence. One more day of rest and then begin a new session of training in rides with cadence.

5th week. 3 rides with climbs and cadence.

6th week. Eliminate the climbs in the schedule and begin working with series of 30 seconds on steep slopes with a large chain ring. This is an attempt to familiarize yourself to the difference of full effort with full recovery. Complete 5 series at maximum effort with 15 minute recoveries on flat land at 100-110 beats per minute between series.

7th week. Begin touring rides and competitions. Already you will not note any difference with the normal pedal, but you will be able to see a difference in the pedal cadence, and to ride with the same group of people as usual, you will pedal at a lower speed, even though you are training for a smaller amount of time at maximum effort, creating less muscular pain, generating less stress on the joints and protecting the heart so that you can stay active until the end of the day.

In the case of a heart monitor expert, you will be able to save the information from the tours and races you have completed in your computer, and have the opportunity to compare this year's results with those of previous years and see the differences of average heart rate (now lower), time (now less), and average speed (now higher).

3. - COMMAND OF THE PEDAL

The first time I road a bike with the Rotor system was approximately four years ago when my good friend Jacier Sainz Beistegue built a bicycle with the Rotor system incorporated in it for me. The system was sold with the frame and did not have regulation points like it does now; it was all or nothing.

I began with a flat and light 39*19, I thought that I was climbing stairs instead of pedaling, it was different..., I began the climb in a top speed, with all of the chain ring placed and it felt good, but I decided not to use the system because it was halfway through the season and it was too big a change.

The following season better incorporated the system, although I continued asking to change the frame; it was already compatible with any frame, but had a high weight, a disadvantage to the usual crank systems. Now it is very well priced, lighter weight, and while cycling at the 3rd regulation point I have had a slight memory of that time 4 years ago, but now it feels much better, it's fantastic. I am waiting to start using the 4th regulation point with all the desire in the world to see the results.

4. - COMPETITION

I am not going to deny that after my first race with the Rotor system I had to visit the physiotherapist to regain the normal tone of my muscles and this was the strength of the race, slightly improving my physical form. It is known that if you do not accept this realized improvement, your form will not improve and may even worsen. I have since completed four races with the Rotor system, with excellent performance in races and providing me with a small idea of what it really has to offer. I gained improvement in level 5, surpassing my limit and quickly seeing myself change the pedaling rhythm in order to catch someone that had left the group, and I thought, "I could not do this before."

In the last race I was able to attack without the after effect of "a constant pain" in the knees that usually stays after such a maximum effort. This feels good. The investigation will continue with regulation points 4 and 5.

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