SMALL DETAILS WITH IMPORTANT EFFECTS IN SPRINTERS PERFORMANCE

Tomina Petrescu, Toma Petrescu
Spiru Haret University, Berceni Road, No.24, Sector 4, Bucharest

Abstract: Besides **power** development as a form of force for high performance in sprinting events, of the key moments of technical executions including the start is an important phase for previous efficient accelerating after the starting gun shot.
The paper tries to achieve a thorough analysis of the "key" moments in the dynamics of the technique of leaving the starting block, based on sequences that we considered most important in the evolution of sprinters **Usain Bolt** and **Shelly Ann Fraser Pryce's,** the most representative sprinters from the last years.
Through this analysis we intend to realize our sprinters and their coaches, of the fact that they will not be able to progress unless they master the correct technique from biomechanical point of view being known that in the similar training conditions the details will make the difference.
Keywords: *start from the starting-block; angle of impulse; starting block;*

Introduction: From a larger cycle of analyzes on the importance of the correctness of the technical gestures in athletics increasingly major, we proposed in this analysis a detailed approach of the key moments of leaving the starting block. For this we took as a model the two examples that we considered the most technically efficient namely Usain Bolt of male sprinters and Shelly Ann Fraser Pryce's representations of female sprint,

Problem. Continue regression of the performance obtain by the romanian sprinters in sprint events, makes us to seek continuously technical aspects which have crucial effects on the efficiency of sprinters. Tackling this research we want to stimulate the romanian specialists, to pay more attention to technical preparation in workouts of sprinters, so the results of our athletes decrease the distance that separates them from the worldwide results.

Premise. Starting from the premise that "when values of physical training are the same, the details make the difference", we proposed a biomechanical analysis of the start departing from starting block.

Hypothesis. We started the research on the assumption that the smallest biomechanics deviations of the start in sprinting events can make a difference.

Methods. For the study we conducted two kinograms by five sequences that we considered relevant, of the moment of departure from starting block, performed by Shelly Ann Fraser Pryce, which we believe is perhaps the most technically start of speed runners and Usain Bolt the best sprinter in the last 10 years. We`ve made this choice not because their performances places them in front of the hierarchies of 100 m event, but because the start techniques that they exhibit we consider to be among the most accurate.

Comparing the sequence one of the two kinograms, representing the "set" position it can be observed that Usain Bolt secures first block closer to the line of departure, compared with Shelly Ann Fraser Pryce. This way of alignment of blocks allows Usain Bolt to raise his hips up above shoulders level in to the "set" position compared with the position adopted by Shelly Ann Fraser Pryce. This position allows him to use more effectively back muscles and one for the hip-femoral joint, when "dive" forward to breaking acceleration 0, something that is observed equally to Shelly Ann Fraser Pryce.

Analyzing their evolution the during five sequences out of the kinograms, which we consider important in our analysis to highlight the chain of actions engaging muscle groups and legs joints.

In sequence 1 in the "set" position, from both kinograms, it can be seen that in both cases the hips are lift as much as possible above the level of the axis of the shoulders, concomitant with the transition of body weight on the arms, so that the projection of the shoulder to fall over the starting line at a distance proportional to the segments dimensions.

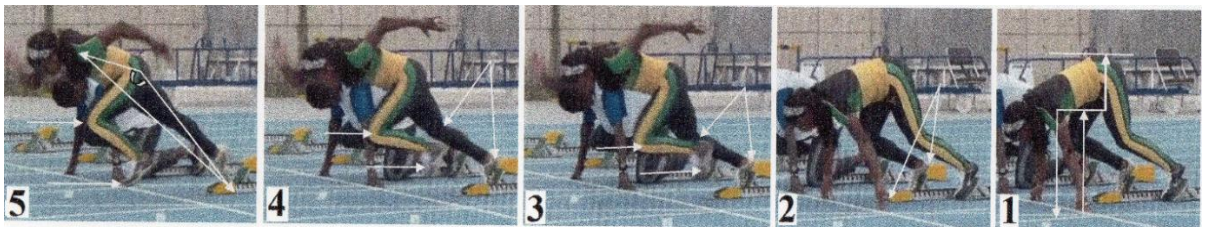

Fig. 1. Shelly Ann Fraser Pryce

Fig. 2. Usain Bolt

At the Bolt's height of 196 cm, the projection of the axis shoulders surpassed more the starting line than Shelly Ann Fraser Pryce whose height is only 153 cm.

Once it has secured the initial inertia of the body, " sequence 2" by engaging the back muscles and gluteal muscles, knee joint extension begins, on end of which begins and ankle extension that simultaneously reaches maximum point.

The ankle extension represents a sensitive moment in the efficiency of departures from the starting block, because of a too early engaging of the extension of this joint turns into a time of amortization (attenuation) of the inertia generated in the first phase of the start.

In the second sequence, the next moment "of the reaction" after the gun goes off, in both cases is observed an extension of the trunk forwards whose inertia generates a higher pressure on the heel, especially on the heel of the front foot.

Once you have secured the initial inertia of the body, "sequence 2", begins the extension of the knee joint, finishing immediately with the extension of the ankle joint. Ankle extension efficiency represents a sensitive moment of departures from starting blocks because engaged too early the extension of this joint turns into a damping- attenuation inertia generated in the first phase of the start. If the ankle extension starts earlier then the knee complete extension, then there is a risk of lowering the inertia that the body would accumulate in the moment of separation from the starting block.

If we follow carefully in sequence 3 of the two kinograms, it can be seen in the two sequences that Usain Bolt "activates" the ankle earlier than Shelly Ann Fraser Pryce, who activates the ankle joint in sequence 4, at the same level that Usain Bolt achieved in sequence 3.

It would be ideal that when the knee extension is closer to completion, and the body has accumulated the maximum possible inertia. Only then the shin muscles can help to increase the final inertia of the body in the moment of separation from the starting block.

This fact makes us suppose that Usain Bolt could still have reserves probably lost by starting the action impulse in the ankle joint earlier, in relation to the knee complete extension.

Even if these moments seem insignificant, given that the levels of development of physical qualities must reach near maximal values, reported to the body mass of the athletes they have made that the physical training is no longer enough to win competitions. Therefore, at present the winners of major competitions are those who managed to perfect motric gestures to maximum level from technical point of view, reducing the maximum dispersion of force vectors and unnecessary consumption of energy substrate.

It is already known that high performance sport the differences are made by the smallest details.

Another aspect that is important to the effectiveness of the start departure from the starting block, is how works the pendulous segments (which generates proportional to the mass inertias of these segments, with each segment angular velocity and the length of each segment) inertia which are combined with expanders forces.

Another aspect that is important to the efficiency of leaving starting blocks is highlighted by the way some pendulous segments whose inertias are combined with expanders forces. In this sense can be observed that in both cases the shin acts on the knee after the "biela-handle" principle with the foot in dorsal flexion, as it can be seen in sequences 3, 4 and 5, in which the horizontal plane of the ankle does not exceed horizontal knee plan.

The last aspect that deserves commented, but no less important, is the angle of the vector of impulse, visible highlighted by the arrow in the sequence 5 of the two kinograms.

So, the vector of the impulse performed by Bolt is linear from the top of the foot leaving the front block and acting on an angle of approximately ± 49 degrees in relation to the horizontal, while at Shelly Ann Fraser Pryce the vector impulse is - the result generated by the inertia of the torso –vectors accumulated during the "plunge" operating on an angle to the horizontal of ± 18°, and the vector generated by the foot of impulse acting on an angle of ± 53 degrees. The resultant of two vectors mentioned above, act on an angle of ± 44 degrees.

Results from the comparison of these angles that his version Shelly Ann Fraser Pryce could be more efficient - by that sensation of "rolling" provides to the legs a space to move lighter and higher amplitude than in an approach similar to the one displayed by Usain Bolt.

Discussions: Driven by the importance of the start in sprinters performance , many specialists have addressed issues of research on various aspects of technical analysis that have the most effective effects in accelerating immediately following the of gun snap.

Without us propose an approach of all the studies we join those who propose some technical approaches witch we consider important too.

Thus, there are opinions that say that overall the athlete must respect certain rituals that have become habits over time, considering that these favors an efficient departure, are not to neglect. Starting blocks should be positioned by the best sensation of balanced in „ set" position.

At the command "set" the body position must achieve the most effective angles in which "the reinforcement" of the joints musculature must be able to emit the maximum force to break instant acceleration 0.

Referring to start T. Latif speaks of the need to concentrate at the time of the start, to have achieved a good evolution for witch the sprinter should automate a routine to allow him to have his attention focused only on "pop" of the gun and the acceleration from the start. [1]

If the athlete feels he has not reached the required concentration Latif T. recommends establishing a rocking motions from one arm to the other, before the command "SET" until they feel they can be sure of departure. [1]

He believes that setting the starting blocks must ensure an effective acceleration to the athlete and not a maximum speed, which is impossible to realise.

Regarding the distance from the start line to the first block of approximately 55-60% of leg length and between blocks, about 42-45% of the total length of the leg dimensions that we consider fair and because of this position the athlete may adopt a balanced position to the command "SET", to ensure the weight over arms through witch is anticipated discharge some of the pressure on the legs.

At the "SET" position existing levels of resistance will be the main factor that will determine the angles of the knee. The front leg knee angle should be between 90 degrees and 110 degrees values and back leg knee angle values between 120 degrees and 135 degrees.

With respect to these angles we believe that raising the hips up above shoulder level ensures the athletes breaking acceleration 0, can not be addressed only by those who are not strong enough. [2]

Such a position is very well exploited by the powerful athletes too to shorten the time of detachment from the starting block and can make better use of force on the first steps 7-8 from the start.

It is something that ours experienced and with good results.

Regarding inclination of blocks, T. Latif [1] suggests 30 degrees to degrees the front and at 45 degrees the back block, a proposal with which we agree. This particular inclination of the front block opens the more the angle of the front foot, this ensuring a faster and lighter extension of the knee like Usain Bolt thing that it can be seen in Fig. 2. [3]

But there are still opinions recommending athletes who are well trained to use a lower

position "in the idea that they use more efficient the force" during acceleration phase, something that we disagree, and in sequences 1 on both kinograms Bolt raises the hips until the angle between shin and thigh reaches 130 degrees and the angle of the foot from behind reaches almost 140 degrees and Price[4] that has 153 cm height to achieve a faster extension of the knees rises the hips high enough, but secures blocks farther from the starting line than Bolt, relative to his height, and achieves an angle of more than 110 degrees on the front and at an angle almost 140 degrees on the back foot. This shows that breaking the acceleration 0 is easier and faster because the feet leave the starting blocks fast starting the acceleration.

Ideally, the blocks should be at 30 angle. An angle of 30 degrees using the best the cycle stretch - shortening, which means that will get the most power out of from stretch reflex, but without increasing the time of pushing the blocks.

Conclusions:

1. In the "set" position pending for the gun to go off the gun hips should be raised high enough to use at full capacity the potential of the related to hip joint and back muscles in the moment of "breaking the acceleration 0".
2. In the "set" position heels pressure on the blocks must ensure the transition of body weight to the arms at a rate of about 60%.
3. Pending for the gun to go off, the pressure on the heels will provide the reaction bearing without "dead times" that could occur until the heels is fixed on the block.
4. By the time he foot of the front block completes the impulse, the shin of the foot rear acts on the knee, like a piston parallel to the ground up to maximum flexion of the thigh on the hip, with the knee reaching maximum point of the upsurge forward.
5. Without having the experimental certainty, an approach of departure from the starting block like the one Shelly Ann Fraser Pryce realized seems to be more effective by the freedom of movement of the legs, ensured by the space between the trunk and the running surface.

References

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