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COMPARISON STUDY BETWEEN THE EFFICIENY OF THE START TECHNIQUES IN THE ROMANIAN COMPETITIVE SWIMMING

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Abstract: *performance in competitive swimming is influenced by the swimmer's figure, by the force and resistance of muscular factors; nevertheless the most important key factors are represented by the swimming techniques including the strokes, the take-off, the turn, touching the wall and the start. Therefore, the shorter the swimming distance, the more important the starting effect. Many start techniques are used in competitive swimming, such as grab start, track start or swing start. The grab start and track start are among the most popular techniques currently used for individual competitions.*

Key words: *swimming start, track start, grab start, kinetics, kinematics.*

1. Introduction

The biomechanical and kinetic analysis of the swimming start showed that there are significant connections with the race and for most of the events, no matter the start rhythm, the starts are different for short and long races, both in the case of females and males. In Romania, the grab start is nowadays more frequently used than the track start or swing start, especially by swimmers participating in competitions. In 2000, the Olympic Games from Sydney represented the cradle of the grab start, bringing a new start trend through the grabbing of the block-start with the hands, a clear aspect noticed in the Olympic Finals [7]. The arm swing start was not used by any of the finalists.

The athletic start called track start is in fact a basal version of the grab start, with one leg placed forward. Two versions of the track start were identified: the track start with the centre of gravity on the front and the one with the centre on the back. Recently, Welcher compared the grab start with the track start with CG on the front and on the back and reached the conclusion that there are no significant differences between the two techniques regarding the time registered at 5m off the block-start [5]. The objective of a swimming race is to cover

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the required distance as fast as possible, the races being won or lost by a hundredth of a second. A race is made up of a number of key elements: the free-style, the start, the turns and the finish. During the start phase, the swimmer registers the highest speed and that is why it is essential for the swimmer to maintain the speed off the block-start as long as possible, before slowing down for the race rhythm. [5]. Although the time a swimmer spends for starting is less than the one for the free-style and turning phase, an efficient start is essential for success [4].

For all swimming races, an efficient start depends on the actions coordination on the block-start and the swimmer's entry in the water, with the purpose to positively influence the following phases of the start and the race. The flight distance, the entry angle, the depth after the entry and the entry speed are significant factors which have to be closely observed by the coaches and correctly assimilated by the swimmers, in order to reach the best values for these variables, with the purpose to improve the execution of swimming start phases.

The conditions of a superior start include a fast reaction time, significant strength for the jump, high take-off speed and a decrease of the drag force during water entry. A dynamic position with a decreased resistance during diving, in order to minimize the loss of horizontal speed as well as an increase of propulsion efficiency, can contribute to a superior start. [3].

The time a swimmers spends for the start represents between 0,8% and 26,1% of the total race time, depending on competition. [6].

A fast start is characterized by the fast positioning of the gravity centre to the front, while the legs are in contact with the block-start. It is well-known that the start implies multiple abilities, concentration, attention, coordination, projecting the body forward, diving and under water activities.

2. Objectives

The objective of this study is to compare the efficiency of the swimming start types during competitions. The analyses of the grab start and track start examine the position on the block-start, the reaction time, the flight and the trajectory from the block-start to the water entry point, the distance between these two points, the time of water diving and the distance from the block-start until the exit point, at 15m.

3. The purpose and the tasks

The main variables presented above, which will be taken into consideration in order to determine the performance parameters of the swimming start, will establish the results of the start efficiency. By mathematical comparison of these results, we will reach objective conclusions. The best results will lead to the promotion of that specific starting style in the national competitions. With the help of new information presented to the sportsmen and coaches, we aim to contribute to the efficiency increase regarding the technical training of the start in sprint swimming, in order to attain better and noticeable results.

4. Hypotheses

1. The hypothesis of this study started from the acknowledgement of poor sprint swimming results in international competitions from the last years. The start in a sprint race has a high contribution to the final result of the race. The necessity to know the efficiency of the current predominant start style on national level and its adaptation to the present international model is maximal. It is assumed that the swimming start style is not adapted to international requirements, which is established by the modification of the block-start in international competitions.
2. All international competitions take place on a block-start with an inclined plate, that Omega Company called OSB11. Therefore, the start style has to be modified in order to make the reaction time and the take-off time from this type of block-start with an inclined plate more efficient. A preliminary training of the start is required in order to use this new type of block-start. Lack of training in addition to lack of preparation for this type of start will lead to its deficient use during competitions, therefore blocking the performance objectives.

5. Methods

The study was carried out with 5 senior and junior subjects, from the national Romanian league, from different swimming clubs. Their height varies from 1.68m to 1.92m and their weight is between 65 and 80kgs. There were 3 male subjects and 2 female subjects taking part in this study. The subjects executed 5 grab starts and 5 track starts, being recorded with a video camera. The materials that were used for research belong to the D04 Centre – "Advanced Research on Mechatronics", within the Faculty of Mechanics, Transilvania University of Brasov - contract based collaboration. During testing, a "Trouble Shooter" video camera was used, filming with 60 frames per second, in high-intensity artificial light (placed on the side of the block-start), ¼ diagram, and the start was recorded with an objective with 12mm focal length. On this data was carried out the kinetic and kinematic analysis of the start. The values were mathematically interpreted. The mean of individual results was calculated and the final results are presented in Table no. 1. After analysing the images, the values of the observed parameters were set: initial position on the block-start, reaction time, flight, trajectory between the block-start and the water entry, distance between the block-start and the water entry point, underwater diving time and the distance from the block-start until the exit point.

Total time values will set the start result up to 15m.

The comparison of the grab start and track start with the help of kinematic and kinetic variables is given by the maximal resultant of the ground reaction force, vertical and horizontal force, SSI and impulse. SSI efficiency is obtained by the horizontal entry distance divided by SSI. The momentum efficiency is the horizontal distance on impact divided by the momentum. All kinetic variables were normalized by the body weight, while those kinematic by the height.

Table 1

Comparison between track start and grab start expressed in kinematic and kinetic variables (CG = centre of gravity, H= height, p= difference between the styles <.05)

Registered parameters	SSI (s-1•GC.)	Momentum (s•GC)	Entry distance (I.)	SSI-Efficiency Index (kg-1•s2)	Momentum-Efficiency Index (kg-1)
Grab start	2.16 ± 0.366	0.50 ± 0.045	1.77 ± 0.096	0.84 ± 0.121	3.57 ± 0.262
Track start	1.55 ± 0.372	0.38 ± 0.074	1.66 ± 0.115	1.24 ± 0.537	4.59 ± 0.808
P	0.002	0.003	0.006	0.053	0.010

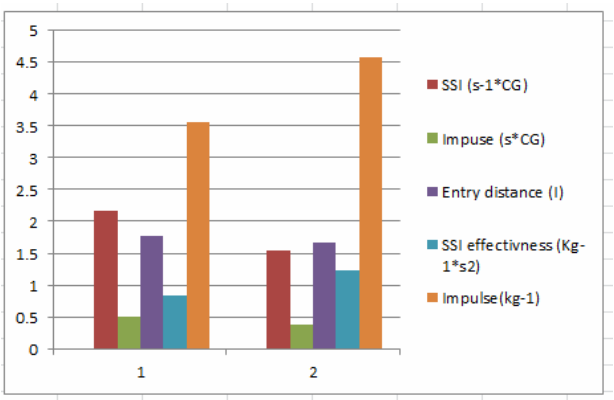

Chart 1. *Comparison between grab start (1) and track start (2)*

6. Results and discussions

Significant differences between the two types of start were found in the case of the maximal ground reaction force, the SSI, momentum, horizontal entry distance and the momentum efficiency index. However, there were no significant differences between the two starts, neither for the maximal horizontal and vertical force, nor for the SSI efficiency index (Table no.1).

All values are expressed as mean ± standard deviation, while P values smaller or equal to 0.05 were considered statistically significant.

This could be due to the difference in the lower joint ankle and lack of coincidence of maximal force for both joints [1]. The momentum was a representative factor, which influenced the flight velocity after take-off.

In this study, the momentum and horizontal distance at entry were bigger for the grab start as opposed to the track start. However, the track start efficiency was more increased as compared to the grab start (as indicated by the measurement of the momentum-efficiency index) [2].

The reason can be the increased start angle of the track start and the higher flight trajectory. This kind of kinetic and kinematic data integration along with their derived efficiency can offer specific information regarding the technique of swimming starts to swimmers and coaches.

7. Conclusions

The main principles of a successful start are represented by the increased velocity, the higher horizontal distance on impact, the optimal entry angle and other similar parameters. Nevertheless, the quantitative evaluation of the starts shows not only performance on bigger distance (for example grab start), or the reaction force, but also an increased efficiency (as the case of track start), which will offer an in-depth perspective on some improved start abilities.

As a conclusion, the track start has a more increased efficiency regarding the adaptability of the start technique to the Omega OSB11 block-start.

8. Recommendations

As the new block-start OSB11 will be introduced in the Romanian pools, the adaptation of the track start style to competitions will be required. In order to introduce this block-start, the training should begin as early as possible in the case of children and juniors, in order for the adaptation to be easy and rapid when the OSB11 start is brought in. The training for each phases of this track start requires a lot of time, as this is a changing process.

It is recommended that the coaches and swimmers spend time adapting to these new block-start platforms, which are internationally used, and also training for a more efficient technique of the track start, depending on the new block-start. All international championships are carried out in pools already having this new block-start with an inclined plate; the quick implementation in training of the ventral track start technique is required, which is best adapted to this type of block-start.

We recommend this track start style to be introduced in the teaching methodology of FRN, starting with children and juniors.

For more efficient start it is recommended adaptation of an adjustable device, adapted anatomical, physiological and psychometric to individual particularities of the athlete. This device provides both rear and front leg support, for a stronger push when the athlete leaves the start-block, ensuring a more stronger and efficient start.

References

1. Lyttle, A., Benjanuvatra, N.: *Start Right? Biomechanical Review of Dive Start Performance*. Available on: http://www.nih.no/upload/BMS2010/Documents/BMS2010_BMS_XI_final_lowres.pdf., 2005, p.1-2.
2. Honda, K.E., Sinclair, P.J., Mason, B.R., Pease, D.L.: *A Biomechanical Comparison of Elite Swimmers Start Performance using the Traditional Track Start and the New Kick Start'*. In: XIth International Symposium for Biomechanics and Medicine in Swimming, Norwegian School of Sport Sciences, 2010, p.94-96.
3. Maglischo, E.: *Swimming Fastest*. (revised ed. of *Swimming Even Faster*). Champaign, IL. Human Kinetics, 2003.
4. Miller, J. A., Hay, J. G., Wilson, B. D.: *Starting technique of elite swimmers*. In: Journal of Sports Sciences, 1984, p.213-223.
5. Welcher, R.L., Hinrichs, R.N., George, T.R.: *An analysis of velocity and time characteristics of three starts in competitive swimming*. In: XVIIth ISB Congress, Exercise and Sport Research Institute, Department of Kinesiology, Arizona State University, Tempe, AZ 85287-0404, USA, 2008, p. 400.
6. Zatsiorsky, V., Bulgakova, N., Chaplinsky, N.: *Biomechanical analysis of starting techniques in swimming.* In: Swimming III:

Proceedings of the Third I International Symposium of Biomechanics in Swimming Edmonton, Alberta. University of Alberta, 1979, p. 199-206.

7. *** http://www.swimmingcoach.org/publications/JSRVol5_No2_1989