INFLUENCE OF PLYOMETRIC TRAINING ON THE KINEMATICS OF THE 50 METERS FRONT CRAWL START

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INTRODUCTION

As eminently terrestrial beings, our initial swimming movements are raw and far from being efficient in the water. Our physical shape is basically unsuited for this objective. Even though, training techniques may produce surprisingly easy and correct propulsion, what explains the whole history of men’s fascination with swimming (Colwin, 2000). Time passed and swimming evolved. New techniques and styles appeared, as well as different range competitions.

The 50-meter freestyle is considered to be the fastest swimming competition, and lasts for about 22 seconds. Studies show that a 1-meter increment in the start power will lead to a 1.39 seconds reduction in the competition. Thus, the use of all phases (start, entrance in the water, swimming, turns and finishing makes the difference in successful competition.

In swimming, a good start will make the first passage be between one or two seconds faster than the subsequent ones. Although lower limbs (L.L.) contribute to a lesser degree in the freestyle propulsion in long course competitions, their contribution to short course competitions may be significant (Adrian et al, 1966, Holmer, 1972). According to Counsilman et al. (1988), improvements in the anaerobic power of lower limbs lead to gains in the start impulse, positively influencing the performance of the athlete. Several methods have been used in order to improve the anaerobic potency of L.L. Among the most acceptable ones are resistance training using weights (isotonic, isometric and isokinetic), circuit training, However, the use of plyometric training has been reported as one of the more efficient methods to achieve this aim (Maglischo, 1999).

According to Zatsiorsky et al (1979), several start techniques have been developed by coaches and swimmers in order to improve start efficiency. Counsilman et al. (1988) described three qualities that are necessary for a good start. They are: good reaction time, explosion and good mechanics. Studies show that reaction time is a physical quality related to neuromuscular transmission, and consequently, of low trainability. Because of this, explosion training related to correct mechanics may be the determining factor for good performance in freestyle start.

The objective of the present study was to assess the changes in the mechanics of freestyle start movement due to plyometric training, analyzing the following variables: height, distance, time and velocity.

METHODS

An intentional sample was used. Volunteers in this study were systematically involved in swimming for at least two years. Twelve male swimmers, from 16 to 20 years old, from the UNAERP (Universidade de Ribeirão Preto) swimming team were analyzed. They were randomly divided into two groups. Group A consisted of six individuals who, besides participating in the normal daily training of the team, were submitted to plyometric training twice a week, during ten weeks. Group B (control) consisted of six individuals who took part in daily training only. Both groups were evaluated in the initial period, and tested again after 10 weeks of training.

Measurements were made based on kinematics and a jump timer. Collection of data was performed at the swimming pool of Universidade de Ribeirão Preto. Athletes presented themselves two hours before the test. At this moment, they were filed and numbered in the records, besides being informed about the procedure to be followed. Their respective anthropometrical points were marked. The camera was placed in the lateral edge of the pool, filming the sagittal plane of the movement, 13 meters away from the center of the start platform and 1.5 meter from the ground. Adequately marked athletes were submitted to warming up out of the water, while calibration was performed. They were then called one by one, in a crescent numeric order, and performed the start after the command “assume your positions” and the sound of the bell in the “S.S” equipment (device that emits a simultaneous sound and visual signal, developed by the LAPIBE – Laboratório de Psicologia e Biomecânica do Esporte [Sport Psychology and Biomechanics Laboratory]). Each athlete performed three attempts in a five-minute interval. After each attempt, marks were reviewed. If necessary, they were corrected or replaced.

The “VIDEO” program performed calibration of the system, recording of the points, two-dimensional visualization of the coordinates, and storage of data. For the presentation, analysis and management of the data, the “UDP” program was used. Both programs have been developed in the Institute of Biomechanics from Cologne, Germany.

By means of the jump timer known as Jump Test – used in laboratory tests – athletes were informed about the performance of the test, the importance of maximum effort and the objective of reaching the maximum possible height. After a 10-minute warming up in an ergometric bicycle, the athlete to be evaluated was guided to the jump platform. The technique used for the determination of the vertical jump was Squat Jump (jump from a squat position). The athlete to be evaluated starts the movement from a static position with knees bended in an approximate 90-degree angle, hands fixed
in the waist, parallel feet corresponding to the width of the shoulders. From this initial position, only ascending movement is allowed. It is, therefore, a jump without preparatory movements, performed from a static position. After athletes were adequately positioned, command “prepare” was issued. After the sound signal from the program, the jump attempt was performed. Five attempts were to be performed, with 10 seconds between each of them. The result was the mean of the three best attempts. Data were directly stored in the software. The following data were presented: number of jumps, height reached, initial velocity of each jump and graphic presentation of the data. Vertical displacement of the athletes was the control measurement of L.L. anaerobic power.

RESULTS AND DISCUSSION

Figure 1 shows the start movement in real time and distance. The center of gravity of the model was used as reference for the analysis of the resultants in coordinates “X” and “Y”.

![Figure 1: Anthropometrical model in the start.](image)

Results obtained with the variable horizontal displacement are shown in Figure 2. No significant differences were observed, using the Wilcoxon Signed Ranks test (p<0.05).

![Figure 2: Horizontal displacement for Group A (plyometric training) and Group B before (b) and after (a) ten weeks training.](image)

Palmer (1990) recommends great and quick horizontal displacement as determinant for a good start. Therefore, keeping the same horizontal reach and velocity does not seem to be important to improve results, suggesting that changes in movement performance are not statistically significant. Statistical analysis (Wilcoxon Signed Ranks) (p<0.05) of the variables time, vertical displacement and velocity did not show significant differences, either.

Figure 3, shows the results obtained in the jump timer. They do not indicate significant differences between the samples, according to Wilcoxon Signed Ranks test (p<0.05). This suggests that there was no significant increase in L.L. (lower limbs) explosion.

![Figure 3: Vertical displacement in the Jump Test, for Group A (plyometric training) and Group B before (b) and after (a) ten weeks training.](image)

According to Counsilman et al. (1988), an improvement in L.L. anaerobic power leads to gains in start impulse, positively influencing the performance of the athlete. Other studies describe the start as a movement that demands special coordination, which may be limited by physical factors. Weineck (1986) reports that a minimum of strength and good velocity, associated with a certain degree of mobility are indispensable for a quick and able movement. It shows that psychophysical fatigue leads to a decrease in movement precision. Zakharov (1992) considers that muscular tension is a factor that negatively affects the capacity and the results in coordination exercises, indicating that excessive muscular tension generally appears as a result of fatigue, pain or psychological stress. Therefore, the preparation stage, as well as the levels of fatigue and stress may interfere in the results.

REFERENCES