Analysis and Exploration of Mechanical Factors in Swimming Speed

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Abstract: Swimming is a popular sport, which can strengthen the body and is the main sport in our country. All the sports equipment related to the water environment need to pay attention to the mechanism of water and the use of fluid dynamics principle to optimize sports skills can better achieve the goal of free movement in water. On this basis, this paper analyzes the mechanical factors of swimming speed, aiming to improve the positive effect of mechanical factors on swimming performance for reference.

1. Introduction

In physics, the study of hydrodynamic factors is mainly divided into hydrostatics and hydrodynamics. One of the most common swimming activities is closely related to the water environment and fluid dynamics. Therefore, to improve swimming speed, athletes need to understand the various mechanical factors in the water and determine the best swimming style and skills to make full use of the positive fluid dynamics of swimming to achieve excellent swimming results.

2. Analysis on mechanical factors in swimming speed

2.1 Fluid mechanics principle

In physical fluid dynamics, the forces acting on objects are more complex and Galileo's transformation principle is used to simplify the stress analysis process. As what is shown in the Figure 1 below:

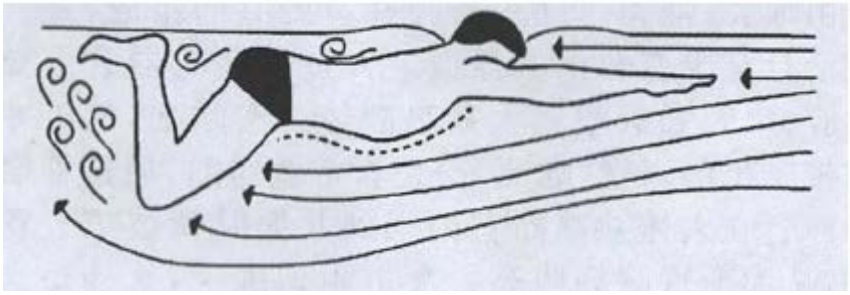

Figure 1 Athlete fluid dynamics diagram

Figure 1 shows that in the case of specific human body and arm internal forces, these internal forces are all hydraulic forces. In applying Galileo's transformation principle to swimming equipment, the force between the body and the water is constantly changing. The human body movement state can only be analyzed from the human body and the arm.

2.2 Determination of reference

During the hydrodynamic process, the arm cannot get fixed support, so the main body moves 10 forward and the arm moves backward. This choice of reference can be verified and it also effectively reflects the theory of motion and the theory that human body cannot obtain fixed support in water, which shows the real state of human body movement in water. Reference theory is the key to the study and analysis of swimming mechanical factors and is to help restore the most realistic

sports state. This study provides sufficient reference materials for relevant researchers.

3. Force analysis of swimming movement

3.1 Force on arms

Current swimming books and textbooks are important references. Underwater, the center of water pressure is on the forearm and the whole arm may be subjected to resistance but also can generate driving force. This state is in the misunderstanding of swimming technology, so the swimming pool can’t be used as a reference. The arm is a shoulder strap, moving the body forward and the lower part of the arm backward. At this point, the stress is applied to the arm. The situation is as follows: when the body moves, the front end of the arm produces a force. When the arm encounters water resistance, the resistance is less than the force of the arm movement and the arm moves backward. At the moment of motion, resistance transfers force to the shoulder joint. Because of the resistance, it should be greater than the motion of the arm and the shoulder joint will move forward. The whole arm has an opposite force transfer, which means it will rotate at a certain point and the movement point will cause the body to move forward.

3.2 Rotation points of arms

During the use of the swimming pool as a reference, the rotation position of the arm stroke is maintained at the arm rather than the shoulder joint. After determining the turning point, the athlete's arm turns longer during the exercise. When the propulsive force is very short or it changes, or when the propulsive force increases, it will rotate as the point moves closer to the palm. Experimental studies show that when athletes are in the process of swimming, the distance between the start and end of the push is very different. If the starting point of the swim is at the end of the push, the speed is closely related to the length of the distance. When athletes swim and swim faster, the more they set the starting point of your arm and the more they push the end point and the slower they swim. Because the swimming level of the athletes is obviously different, the rotation position of the arm is also different. Changing the rotation point may directly affect the resistance of the player's arm. Near the athlete's arms and wrists, the only area of resistance is the palms of the hands and the front of the swim will gradually increase. Therefore, in the actual swimming process, high elbow swimming posture should be adopted to increase the potential, promote the area and speed up.

3.3 Pressure center

From the perspective of arm propulsion, the pressure center is located in the forearm. To improve swimming speed, it is necessary to improve forearm shape resistance and water angle. Analysis of arm rotation points has shown that swimmers who are better at swimming can rotate and move the points not only on their forearms but also on their palms. At the same time, according to the requirements of swimming speed, the direction of swimming should be adjusted. For example, on a quick moving trip, the athlete will bend the arm appropriately and maintain a vertical position between the palm and the water to better control the water pressure.

3.4 Resistance to growth

When swimming speed increases due to the drag effect, drag increases accordingly. In practice, however, swimmers' speed increases with their arms. As the position of the turning point decreases, the ratio between the area of pushing resistance and the area of previous resistance changes significantly. When the turning point is at the elbow, the forward drag ratio in the advancing area is 1:3. When athletes rotate their arm and move up at the wrist, the ratio of the pushing area to the forward drag area is 1:7. It can be seen that with the increase of swimming speed, the propulsive area increases significantly and the propulsive force of the athletes' arms will be further improved. To better upgrade, swimming speed requires the swimmer to improve arm strength and other aspects of power.

3.5 Arm motion

According to modern swimming theory, the straight arm movement has a specific game limit and uses high elbow flexing to increase swimming speed. According to the results of the dynamic position theory analysis, if the pressure center of the turning point of the athlete's arm moves downward, the forearm propulsion resistance will also be reduced and the elbow movement of the bending arm will be very high, which makes it difficult for good swimmers to play a bigger role. At the same time, as a reference for the human body, when the arm is tilted, the arm will move at the same speed, the elbow will reach the same position as the push and the body will move faster than the arm. If the elbow is higher, the elbow can slow the stroke of the palm, leading to a stroke in the water. To prevent this, wrist technology was initially added. The palm of a swimmer’s hand touches the largest body of water and actually increases his travel speed. As the same straight arm stroke increases, so does the palm speed and stroke path and the stroke. Wrist movement is adjusted to absorb water in the largest area of the palm, but can also cause problems such as reduced frequency. Therefore, in order to increase swimming speed, it is necessary to unify the stroke and frequency to ensure the maximum swimming speed. However, there are some differences in the length of the athletes' arms, but by changing the swimming time, the stroke and frequency can be more appropriately controlled according to the angle of the crank arm. Specifically, athletes with shorter arms can get straighter cuts and lengthen their arms faster by swimming. The operator of the long arm uses the miniature arm to assume that the support capacity reaches its limit and the arm will contract normally or be shorter, which can help better control the travel and frequency.

4. Swimming speed and influence of mechanical factors

4.1 Resistance

Because of the air and water resistance, swimming is more difficult and uses more energy. Water is much denser than air, so it takes about 90% of a swimmer body's energy to resist swimming. Water resistance and density also provide the necessary conditions for the human body to float in water. Body weight and lung capacity directly affect swimming speed.

Water resistance is higher than air resistance when the object is moving at the same speed. It's about 800 times for the size. Controlling the ratio of water is an important skill to improve swimming speed by changing the position of the palm and analyzing the difference in water resistance in detail. When swimming, the body experiences two different kinds of resistance. First of all, head-on resistance is called resistance. Swimming forward in front of the body is resistance to the face to reduce the disadvantage of resistance to swimming speed and the friction resistance of the body. After water flows through the body, the force generated by the friction between the water body and the human surface is required to reduce the friction resistance and the friction resistance of swimming at low speed will be reduced.

4.2 Propulsion

The main driving force in water is the force that pushes the body forward. In the actual swimming tour, it is necessary to improve the speed of the athletes and further adjust the swimming behavior. As we all know, force and reaction are equal in magnitude and opposite in direction. If one move backwards, he can push the body forward. There are some differences in propulsive force between different swimming positions. The athlete adjusts the role and range of the traditional curved arm, setting the force that should be given to the water to obtain greater resistance, which can effectively increase the propulsion and actually improve the swimming speed.

5. Conclusions

All in all, mechanical factors can directly affect the speed of swimming, which is very important for swimming performance. Therefore, it is necessary to deeply study the mechanical factors of swimming so as to save energy, reduce resistance and increase driving force through standard

movements. At the same time, during swimming, athletes also pay attention to the water environment and choose the best swimming posture based on the characteristics of the water environment.

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