CZU796.012.13:796.2+796.02

DEVELOPMENT OF SPEED QUALITIES BY IMPROVING SWIMMING TECHNIQUE ELEMENTS USING TECHNICAL MEANS

***Scorțenschi Dmitri*[1]**
[1]*State University of Physical Education and Sport, Chisinau, Republic of Moldova*

Abstract. *This article scientifically substantiates the use of untraditional modern technical mean –"aqua-tow", in swimming for monitoring the improvement of the swimming speed due to the improvement of front crawl swimming technique. Lately, in the training process of the swimmers for the development of speed, various means of force and technical training directly are widely used in water. The research study consisted in improving the methodology of training the high performance swimmers through the inclusion in the general system of computerized hydroremarker (HRC) for developing and realizing the accumulated potential - in speed.*

The technical training of competitive swimmers is one of the key positions which determine the level of sporting performance. Thus, the coaches engaged in different stages of training in sport schools are concerned of the issue related to the effectiveness of correction of the swimming techniques and to the relevant swimming technique control system.

Keywords: *competitive swimmers, aqua-tow, sport swimming technique, speed.*

Actuality. The long-term training of swimmers is a complex process. Each stage of training is peculiar. Stage 1 - „beginner"; Stage 2 - „advanced" (general, auxiliary and special work-out ratio 45:45:10); Stage 3 - „basic specialisation"(the abovementioned work-out ratio is 20:40:40); Stage 4 - „maximum development of individual skills" (the share of specialised training reaches 70%) [3].

Considering the abovementioned, it may be noticed that during the Stage 2 of training we already use special work-out exercises (10%). Therewith, the specialized literature and the coaches' training experience show insufficient use of technical means for analysing and exploring the impact of training or of special exercises on the development of swimming technique. As a matter of fact, such technical means are used but only subjectively, as many coaches obtain the information with the naked eye or using the videos recorded on their smart-phones, above the water [6, 7].

A number of specialists in the field of swimming [11, 10] consider that the parameters of stroking technique may be used as control values in the process of improving the swimming technique, being, at the same time, the object of the training impact. This assertion is based on the fact that during the long-term swimming technique improvement process most of the mistakes relate to arms movements. The experiment revealed [8] that most conservative mistakes of stroking technique during the front crawl include: elbow rush in the catch phase; loss of arm speed in the push phase; extension of the wrist joint in the push phase; extension of the wrist joint in the catch phase; short stroking.

Based on the above, it can be mentioned that the sport swimming technique as a research object is always under the study of specialists. However, most of the scientific research has been conducted on competitive swimmers, while research works dedicated to studying the swimming technique during previous training stages are fewer.

In this context, the **purpose of the research** has been determined – which comprised the improvement of the front crawl swimming technique in swimmers during the basic specialisation stage by using the computerised "aqua-tow" (swimmer towing device).

Hypothesis – it has been assumed that towing the swimmers will contribute to changing the biomechanical parameters of the swimming technique.

The existing research based on the principle of towing the swimmer in water at an over speed [12] confirms the hypothesis of increasing the swimming tempo, pace length, force and speed of competitive swimmers etc. In our research we have attempted to develop a method of using the aqua-tow at the basic specialisation stage, stating thus the efficiency of the proposed method. Thus, the preliminary and the main experiments have revealed that the tow has the most optimal impact during the pre-competition meso-cycle. The volume and the set of exercises have been determined.

Based on the facts stated in the topicality, it has been examined the issue related to changing the biomechanical parameters of the swimming technique. Thus, in order to achieve the proposed goal, within the Department for Swimming and Tourism of the State University for Physical Training and Sport, a mobile platform for the action-type video camera adapted for underwater shooting was built. During the preliminary and the main experiments, both, above the water and underwater shooting has been taken of the swimmers with race speed and over speed (towing).

During the preliminary experiment we have tried to establish the parameters of race speed swimmers' technique and the possible changes of the parameters of the over speed (using the aqua-tow) swimmers' technique. The experimental data obtained revealed that the phases of crawl technique using the arms in the investigated subjects (n=20) differ from those presented in the specialised literature (Table 1).

Table 1. Arms stroking phases during crawl at 50 m distance within the preliminary experiment

50m	Stroking phases						Total stroking cycle
	Entry, glide	Catch	Pull	Push	Upsweep	Pullover (recovery)	
Standard data	0,07–0,17s	0,08–0,30s	0,35–0,40s		0,05–0,08s	0,28–0,33s	1,16–1,22s
1.Initial (50m)	0,19	0,25	0,13	0,25	0,05	0,37	1,24
2.Tow (50m)	0,16	0,24	0,13	0,23	0,05	0,35	1,16

Also, by detailed analysis of the video made under water and of the maximum speed swimming technique, there was determined the whole range of mistakes mentioned by many authors[1, 2, 7, 9]:elbow rush in the catch phase; loss of arm speed in the push phase;short stroking etc.

Performing the same analysis of the over speed swimming technique, within the preliminary experiment, we have found that the execution time during certain stroking phases reduced. But, stroking is not only a simple rotation of the arm above and through the water. It is a complex biomechanical movement which must be achieved with permanent support and efficiently on the water surface for optimal propulsion forward of the swimmer's body with minimal effort. By analysing the video, we have also found that the use of the aqua-tow changed the push

phase by extending the distance covered by the arm for its achievement, making the stroking longer.

After determining the crawl technique variations (tempo, pace, phase etc.), the program for using the computerised aqua-tow during the pre-competition meso-cycle was developed. At the end of the meso-cycle, to wit at the end of the main experiment, we have carried out the same technique shooting activities, but without an aqua-tow (Table 2).

Table 2. Time parameters of the arm stroking phases during crawl swimming(n=10=10) at the beginning and at the end of the experiment

Stroking phases (50m)	Gr.	TI	Standard data	TF	t	p
Catch	**E**	0,251±0,0008	0,08–0,30s	0,241±0,0024	**4,066**	**<0,01**
	C	0,251±0,0010		0,251±0,0010	**0,046**	**>0,05**
Pull	**E**	0,129±0,0020	0,35–0,40s	0,129±0,0016	**0,080**	**>0,05**
	C	0,128±0,0017		0,127±0,0017	**0,174**	**>0,05**
Push	**E**	0,251±0,0015		0,241±0,0020	**4,105**	**<0,01**
	C	0,251±0,0018		0,255±0,0018	**1,498**	**>0,05**
Up sweep	**E**	0,050±0,0016	0,05–0,08	0,050±0,0017	**0,047**	**>0,05**
	C	0,048±0,0018		0,051±0,0007	**1,284**	**>0,05**
Pull over	**E**	0,372±0,0013	0,28–0,33s	0,362±0,0019	**4,144**	**<0,01**
	C	0,370±0,0015		0,366±0,0009	**2,434**	**<0,05**
Entry and glide	**E**	0,191±0,0018	0,07–0,17	0,171±0,0022	**6,930**	**<0,001**
	C	0,191±0,0021		0,181±0,0009	**4,348**	**<0,01**
Duration of the stroking phase	**E**	1,243±0,0044	1,16–1,22s	1,194±0,0050	**7,431**	**<0,001**
	C	1,240±0,0040		1,232±0,0023	**1,804**	**>0,05**

By conducting the preliminary research, we have assumed that the use of the aqua-tow will have a significant impact on the time, space and force parameters of stroking. However, having the final data and performing a series of statistical, mathematical and analytical operations, we have stated that the application of artificially raced speed by 10% more than the competition speed contributes to significant optimisation of the time parameters of stroking (Table 2), which improve the tempo (pace) and race the swimming speed; increase the stroking power; but less the space parameters – improving only the push phase, extending the stroking. Unchanged remained: a) elbow position - elbow rush in the catch phase, and b) palm position in the second half of the push phase –it will be facing obliquely upwards, but not perpendicular to the movement, as according to the rules of hydrodynamics.

The systematic assessment by the coach of the swimmer's technique enhances the opportunity to improve the skills, developing a swimming method that needs less effort. Thus, the energy accumulated on the account of more efficient stroking will help learn the technique more effectively [2].

But, at the same time, we may generally state that positive change of the push phase is an advantage, as the major role of the phase consists in forming the propulsion force during swimming, to wit front crawl swimming [5, 1, 4].

Conclusions. The inclusion of the towing methods in the training process significantly

contributed to a better understanding and performance of the technical elements, considering the biomechanical structure of the stroking phases: water catch (50m),pull, push, up sweep,pull over,entry and glide.

The results of the pedagogical experiment gave the possibilityto establish that the method involving the use of computerised aqua-tow during the pre-competition mesocycle contributes to the rationalisation of the force-speed training process of swimmers specialised in front crawl.

References:

1. Alves C., Vilas-Boas J.P. (1992) Kinematical analysis of swimming freestyle hand-path with and without hand-paddles II In: Rodano R. (ed.) et al, ISBS '92 proceedings of the 10th Symposium of the International Society of Biomechanics in Sports June 1992, Milan- Italy, Milan, Edi-Ermes, p.74-77.
2. Blythe L. (2008) The 100 Best Swimming Drills Maidenhead: Meyer & Meyer Sport (UK) Ltd., ISBN 978-1-84126-337-3
3. http://akvasvit.ru/plavanie/osobennosti-razlichnyx-etapov-mnogoletnej-podgotovki-plovcov/
4. Togashi T., Nomura T. (1992) A biomechanical analysis of the novice swimmer using the butterfly stroke II In: MacLaren, D. (ed.) et al., Biomechanics and medicine in swimming...London, E & FN Spon, p.87-90.
5. Troup J.D. (1991) International Center for Aquatic Research annual: studies by the International Center for Aquatic Research 1990-91, United States Swimming Press, Colorado Springs.213 p.
6. Ганчар И.Л. (2006). Методика преподавания плавания: Технология обучения и совершенствования. Одесса.
7. Дунаев К.С., Федосеев А.М. (2015) Коррекция техники плавания кролем // Вестник ТГУ, №1, с.68-71.
8. Ивченко Е.В. Особенности техники движений у юных пловцов / Е.В. Ивченко, И.О. Шухардин, А.И. Крылов // Совершенствование двигательных действий спортсменов водных видов спорта: Сб. науч. тр. / ГДОИФК. Л., 1989, с. 30-36.
9. Иссурин В.Б., Костюк Ю.И. (1984) Оптимизация пространственного построения гребка при плавании. Теория и практика физической культуры, №4, с. 10-12.
10. Лищенко В.Е. (1997). К построению многолетней тренировки высококвалифицированных спортсменов. Теория и практика физической культуры, № 3, с. 21-22.
11. Мосунов Д.Ф. (1992) Дидактические основы совершенствования двигательных действий спортсмена (на примере плавания): Автореф.дисс. ... докт.пед.наук. С.-Петербург. 40 с.
12. Ратов И., Аллакин Ю., Кочергин А. (1990). Применение искусственно повышенной скорости как средства и метода совершенствования различных элементов соревновательной техники пловцов / / УЕ Медцунар.симпоз.по биомеханике в спорте, июль 3-9, Прага, с. 22.