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OLYMPIC TEAM ROWER STROKE TECHNICAL ANALYSIS

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Abstract. *It is much spoken about and researched how to increase the speed of moving in rowing. Many scientists have researched the technical aspects in rowing. Most part of researches is based on oxygen maximal consumption and other physiological changes during a load. Although there are various researches, stating the technical nuances of leg and arm work, comparatively little attention is paid to the role of the arm work. The cycle length in different distances and having different water flow – before the wind, against the wind and with the side wind is stated. The aim was to research one stroke technical nuances in rowing looking for stroke rate from 24 till 34. A pilot study was carried out. One Lithuanian Olympic team rower was participated this pilot study and he was tested in different stroke rate. The following methods were used in study: test exercise, video analysis with KinezioVideoAnalyzer 3.0. and mathematical statistics. The results: having stated the result average of stroke rate was 28,6 and speed of stroke was 0,82 sec. Conclusions: the obtained data from rower show small differences changing stroke rate.*

Keywords: rowers, stroke technical analysis, stroke rate.

Introduction

The origins of rowing have been around for thousands of years, although in the modern sense the beginning of the sport rowing (Halladay, 1990; Wigglesworth, 2013; Krauksts, 1997) dates back to the 18th century, thus the mechanical form of the boats and the biomechanical basic principles of rowing have changed dramatically. Biomechanics as a science has originated from biology, biochemistry and biophysics, which investigates mechanical properties

and mechanical phenomena in the course of life processes (Fung, 2013; Lanka, 1995), although Aristotle already in the 4th century BC began to perform motion descriptions and tractates. Meanwhile, human biomechanics could be an interdisciplinary study analyzing and evaluating human movements (Winter, 2009). Contrary to classical biomechanics, the dynamics of each joint motion is being studied today (Ivancevic & Ivancevic, 2008), which allows to evaluate movements more accurately. Rowing practice mentions two basic concepts: rowing technique and rowing (Fig. 1) styles (Krauksts, 1997; Kleshnev, 2006; 2007, Cornett, Bush, & Cummings, 2008). Rowing technique is a complex of executed movements in a boat, coordinating individual movements in the body parts, achieving rational use of the body energy and reaching maximum speed of movement, as well as including psychological and tactical training. Thus, athletes are filmed and viewed in different planes, setting the rower's movements in relation to boat movements (Kleshnev, 2004, 2010). Rowing style is a form of expression of the rower's movement, which includes: sitting on the bench, peculiarities of the paddle holding - grabbing, type of the movement during the stroke (Fig. 1), as well as other parameters.

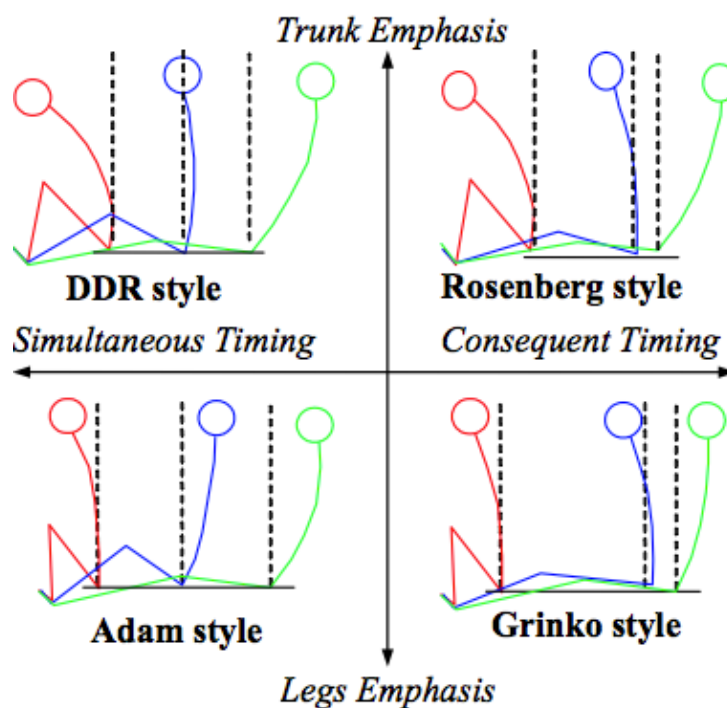


Figure 1 Rowing styles (Kleshnev, 2006)

In rowing, rowing styles are determined by the emphasis on the leg activity and the upper body function (Fig. 2), as well as the time when the movement with the legs and the upper body is started simultaneously or separately.

DDR style – long-lasting strong stroke with the upper body at the same time pressing with the feet on the support.

Rosenberg style – a very strong stroke starting with the legs and then with the upper body, at the end of the cycle, the upper body is tilted back.

Adam style – a strong and long beginning of the stroke with the legs and simultaneously with the upper body, which is less involved in the stroke.

Grinko style – invented relatively recently, with an explicit emphasis on the leg activity at the start of the stroke and a relatively small movement with the upper body (Fig. 2).

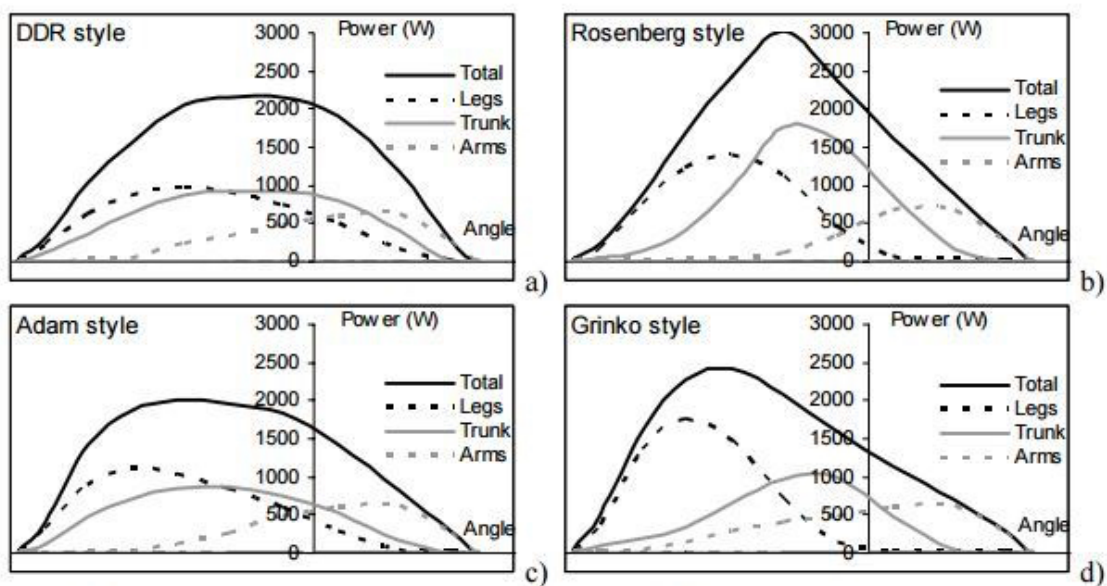


Figure 2 Graphic representation of the power of rowing styles in the stroke phase (Kleshnev, 2006)

As shown in the Figure 2, the system of the highest powers (the body, legs, and arms) during the stroke can be developed in the Rosenberg style, but the most even power in the stroke is achieved in the DDR style. In the Grinko style, which originated from the Adam and Rosenberg style, a strong action is precisely by pushing the feet on the support in the boat. Currently it is considered that these four styles include some other styles (Green, 1980; Kleshnev, 2006, 2007, 2010; Secher & Volainitis, 2007). Each athlete looks for the style or style combination that suits him/her.

Material and methods

The experiment was held on July 2017 in the rowing centre in Trakai in Lithuania. The test exercises in the boat were executed using various stroke rate, starting from 24 up to 34.1 stroke. A Lithuania state Olympic medal holder, aged

33, height 189 cm and weight 91 kg, participated in the rowing video analysis. The video analysis was carried out applying a specialized programme exactly for water sport KinezioVideoAnalyzer 3.0. The video was taken using the video camera Panasonic with 60Hz frequency when filming a rower from the lateral position while riding a motor boat. The obtained data were mutually compared using the method of mathematical statistics – t Test.

Results

In the experiment – test exercise 15 strokes having different intensity and their data, seen in the Table 1, were stated. Preliminary the rower’s strokes in the test exercise could be divided into two groups. The 1st group, where the stroke rate varied from 24 – 27.8 and strokes lasted from 0.82 – 0.88 seconds, shows an average result in the distance. The 2nd group, where the stroke rate varied from 30.3 – 34.1 and strokes lasted from 0.72 – 0.84 seconds, shows a high result in the distance.

Table 1 Stroke rate and time spent in stroke

Strokes	1	2	3	4	5	6	7	8
Str./min.	24	24.8	25	25.6	25.9	26.5	26.8	27.3
Drive t.s	0.86	0.88	0.86	0.86	0.86	0.88	0.88	0.82
Strokes	9	10	11	12	13	14	15	
Str./min.	27.8	30.3	31.9	32.6	33.3	33.7	34.1	
Drive t.s	0.84	0.84	0.78	0.78	0.76	0.74	0.72	

The mean results show that in the 1st group the drive was executed on average 0.86 seconds at 26 strokes per min., and in the 2nd group the stroke rate was 32.7 at average stroke length 0.77 seconds. Stating the p value with the t-Test we conclude that p=0.001 when comparing the stroke length in the 1st and 2nd group, but, stating the differences of the stroke number in a minute, p=0.000. The results of both data show significant differences at p<0.05.

Taking a look at Figure 3, which shows 24 stroke rate rowing, the drive phase and recovery phase can be stated. A rower makes the movement speed curve against the boat, which in stroke is explicitly higher for the hands and trunk, but the leg movement speed is the lowest. Similar tendency can be observed also in other stroke cycles, at different stroke rates.

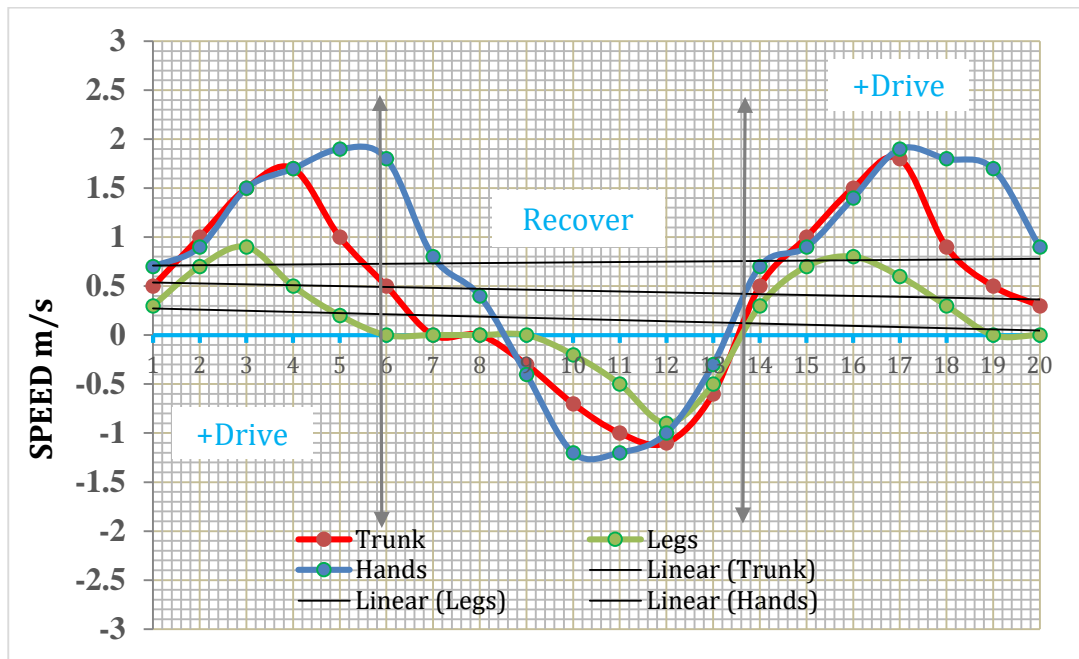


Figure 3 Movement speed of the trunk, legs and hands in one stroke cycle

Stating the result differences between the drive and recovery, it was stated (Table 2) that the movement speed in a stroke for the hands, trunk and legs is positive in connection with the boat which reached: for hands 2.7m/s at 34.1 stroke rate. The highest movement speed of the trunk is 1.9m/s at 31.9 and 34.1 stroke rate, but the fastest of the legs is 0.9m/s, at 34.1 stroke rate, although the leg movement speed is observed similar at all stroke rates.

Table 2 Movement speed in the stroke cycle of the back, arms and legs

Speed	Blade in the water	Knee 90°	Trunk 90°	Blade 90°	Legs straight	Trunk end	Blade in the air	Blade turned	Blade 45°	Blade 90°	Knee 90°	Hands over Stretcher	Blade touches the water	Blade in the water
Hands (m/s)	0	0,9	1,5	1,7	1,9	1,8	0,8	0,4	-0,4	-1,2	-1,2	-1	-0,3	0,7
Trunk (m/s)	0	1,5	1,5	1,7	1	0,5	0	0	-0,3	-0,7	-1	-1,1	-0,6	0,5
Legs (m/s)	0	0,9	0,9	0,5	0,2	0	0	0	0	-0,2	-0,5	-0,9	-0,5	0,3

Discussion

In rowing movements have been studied already from the end of the 19th century, although the research has been approximate. In the 20th century the biomechanical analysis in rowing developed very rapidly, and it is continuing to develop also in the 21st century (Halladay, 1990). In rowing movement structure classically is divided into four phases, although today already five phases are given (Panjkota, Šupuk, & Zanchi, 2006) and even nine micro-phases (Kleshnev, 2007). The classical movement structure in rowing includes four phases which last on average 1.7s, which corresponds to 36 strokes per minute:

Phase 1 – catch

Phase 2 – beginning of stroke

Phase 3 – end of stroke, relaxation

Phase 4 – rest, recovery (Krauksts, 1994; Cornett, Bush, & Cummings, 2008).

In the phase 1 the oar is put in the water, it is followed by the phase 2 – stroke. Stroke is the main phase of the cycle where the movement speed of the boat depends on the stroke power. According to the dominating muscle groups, the stroke phase can be relatively divided into three parts (the leg movement, the back movement and the hand movement). At correct oar pull in the water the boat moves continuously and straight along the water (Mazzone, 1988; Krauksts, 1997; Kleshnev, 2004, 2010; Découfour & Pudlo, 2007), as well as the relative strength or potential power of every part of the body is stated by coordinating the movements of the parts of the body. To provide continuous movement stroke should be executed along the horizontal axis of the boat, and movements in the boat are regular and synchronised. Taking a look at the data obtained in strokes, we can precisely state that the movement speed of the boat directly depends on synchronous action of rower's parts of the body. The legs start the movement in rowing, then the trunk – the back, and the stroke is finished by the hands. If some of these stages is missing, rower will move more slowly, it is sometimes proved by the rowers – beginners, often executing the stroke brokenly or trying to do it only with the hands and legs. Rower, finishing the stroke, takes the oars out of the water. This is a very important movement for the boat not to be hindered, if oars are taken out of the water too late, or vice versa, when oars are taken out of the water too fast and the applied power in the stroke will not be fully realised. In recovery rower relaxes, thus he moves backward along the boat and prepares for the next stroke, testified also by the negative speed curve in Figure 3.

Conclusions

The results show that by choosing a bigger stroke rate, the leg, hand and trunk movement speed increases during the stroke. At the same time also the negative movement speed of the legs, hands and trunk increases during the recovery. The mathematical statistics of the results testify that emphasizing the stroke rate and the time spent in stroke at average stroke rate and high stroke rate significant result differences can be observed.

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