Original Article

The Downward Breaststroke Kick Makes Fast Speed and Increased Lactate Acid

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Abstract: In this study, we assess the effectiveness of utilizing a downward breaststroke kick with regard to the overall time, max speed and velocity per stroke when using a downward breaststroke kick technique. We analyzed breaststroke kick of knee angles from 8 elite world class swimmers. The downward breaststroke kick used in breaststroke competitions resulted in improvements average of 100 yard or 100 meter breaststroke from 1:05.10 s to 1:01.97 s. Increases in performance max speed and velocity per stroke among 9 elite world class swimmers are highly correlated to duration of the kick aerodynamic buoyant force in breaststroke. The downward breaststroke kick also resulted in an increase in lactate acid.

Key words: Swimming, Breaststroke, Downward Kick, Lactate Acid, Olympian.

1. Introduction

The focus of this study is to analyze the downward breaststroke kick and increase lactate acid swimmers to gain additional propulsion when their feet are traveling directly down, after their legs have extended at knee, during the final portion of their whip kick (Fig. 1). Previous study that explored the 1990’s breaststroke kick is very powerful because swimmers can push water back with the soles of their feet for a long period of time. We assess the effectiveness of utilizing a downward kick in the breaststroke regard to the overall time, max speed, tempo, and velocity when using a downward breaststroke kick technique [1].

When analyzing the angle of the breaststroke kick and lactate acid [2] for 8 swimmers of the Olympians, the FINA (Federación Internacional de Natación) world champions, NCAA (National Collegiate Athletic Association) we find the proportion of kicks greater than 170 degree knee-bending increase [3] from 23.52% to 28.26% (Wilcoxon/Mann-Whitney: 0.1449074, p > 0.05) (Fig. 2), competition 100 meter breaststroke or 100 yard breaststroke performance time improved 65.10 ± 8.03 s to 61.97 ± 8.28 s (Wilcoxon/Mann-Whitney: 1.608169, p > 0.10). The lactate acid downward breaststroke kick [4] increased lactate acid 6.933 mmol/L compared to the horizontally breaststroke kick 3.822 mmol/L.

The downward breaststroke kick [5] increases the stroke by tempo and max speed [6] it also creates too...
much lactate acid for the swimmer to hold the form for more than 30 s under current conditions. Breaststroke performance seems to be associated to the downward kick in elite world class swimmers. Breaststroke performance improved through possible reasons are increase velocity to max speed.

2. Methods

2.1 Lactate Acid

The lactate acid was generated by Lactate Pro\textsuperscript{TM} LT-1710 (Arkray, 5 \textmu L, Kyoto, Japan) meter for on-farm determination of the blood lactate acid of tallest finishes [7]. Blood lactate acid of farmed cod, caught by rod and line, was below detection limits of the meter (< 0.8 mM), and confirmed by laboratory assay as 0.459 ± 0.037 mM (mean ± SEM, \( n = 34 \)). The lactate acid test was 60 s wall breaststroke kick; tempo was 1.10-1.70 s/stroke by FINIS Tempo Trainer Pro/Underwater Metronome.

2.2 Participants

The subjects are all very accomplished international elite swimmers. Subject #1 is NCAA (National
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Collegiate Athletic Association) Division I Championship qualifier (height: 1.78 m, weight: 72 kg). Subject #2 is 2016 Rio Olympic Games 4th in Men’s 200 meter individual medley age of 24 years old (height: 1.76 m, weight: 72 kg). Subject #3 is FINA 2018 World Championship short course meter in Men’s 200 meter individual medley age of 23 years old (height: 1.67 m, weight: 62 kg). Subject #4 is three-time Olympian (1992, 2000, & 2004, height: 1.67 m, weight: 60 kg). Subject #5 is 2008 through 2012 NCAA Division I championship finalist and 2009 World University Games. Subject #6 is 2012 London Olympic finalist (height: 1.77 m, weight: 72 kg). Subject #7 is 2018 FINA World Championship short course meter qualifier in Hangzhou, China (height: 1.65 m, weight: 58 kg). Subject #8 is US National Championship Finalist (height: 1.98m, weight: 89kg). Subject #9 is 2008 US Open Championship 1st in 100 meter butterfly (height: 1.77 m, weight: 71 kg).

2.3 Measures

2.3.1 Breaststroke Performance Time Measures

The data of 100 meter or 100 yard breaststroke performance time [8] are collected during FINA and USA Swimming rule regulations sanction swim meet. The race time collections by Colorado Timing System (12 V DC at 750 mA, 5 V at 3.5 mA RS-232 ± 12V, 12 V DC at 0.5 A, 5 V DC) meet manager (S2015-001-007), touchpads (CTS AquaGrip®, TP-195GF), and start system (SS.S, 110240 VAC, 6 W/45 Ω, WSS, VDCA 18-1.2, TXR, JQR003). The breaststroke swimming performance breakout time, breakout distant, split time, drop-off time, cycles, time, tempo and rate, distance per cycle (m/cycle or yard/cycle), velocity (m/s or yard/s) and turn time by Parametrix Race Analyzer.

2.3.2 Breaststroke Kick Angle Measure

We then investigate the knee angles [9] of kick phase of the breaststroke stroke, catch phase, outsweep phase, insweep phase, and wave propulsion phase. While swimming, the subject was monitored from the side plane using an underwater video camera at a sampling frequency of GZ-R400T (DC 5.2 V, JVC, X00EJGTVB, 122A025B). Two angles of the breaststroke kick of the knee movement were analyzed [10] with the Kinovea (0.8.15, 1 GHz, 256 Mo).

2.4 Data Analysis

The breaststroke downward kick increases the stroke velocity by one stroke and max speed and creates excess lactate acid unlikely to allow for normal swimming condition [11] for more than 30 s. The breaststroke downward kick lactate test was 60 s wall breaststroke kick, tempo was 1.10-1.70 s/stroke by FINIS Tempo Trainer. These signals are used to calculate lactate acid with Microsoft Windows Excel and a Wilcoxon Signed Ranked Test.

3. Results

We find when the proportion of kicks greater than 170 degrees knee-bending increases from 23.52% to 28.26%, velocity improves from 1.39 m/s to 1.51 m/s, (Wilcoxon/Mann-Whitney.: 1.6431677, p > 0.10, Fig. 3), but the downward breaststroke kick increased lactate acid 6.933 mmol/L compared to the horizontally breaststroke kick lactate acid 3.822 mmol/L (Fig. 4, Wilcoxon/Mann-Whitney.: 2.6086243, p < 0.01).
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4. Discussion

The aim of this study is to present empirical evidence to show that downward breaststroke kick will generate the most speed, most efficient stroke, but also result in a higher level of lactate acid among elite level breaststroke swimmers [12]. Since 2012, we analyzed the downward breaststroke kick technique using the underwater camera during training and Parametrix Race Analyzer during swim meet. We calculate the knee degrees after training to utilize the technique in the championship meet. In the championship meet, we analyzed performance by Parametrix Race Analyzer to split time, drop-off time, cycles, time, tempo and rate, distance per cycle (m/cycle or yard/cycle), velocity (m/ or yard/s) and turn time.
5. Conclusion

Positive breaststroke performance measured by final tie is associated with downward breaststroke kick in elite world class swimmers. Breaststroke performance improved, although a possible explanation is not only the increased propulsion [13], but also due to less resistance equal to increasing the velocity in the championship meet races. The results of this paper reveal that with proper training and technique [14], the downward breaststroke kick can result in much faster 100 meter or 100 yard breaststroke times for swimmers to be able to mitigate the increase in lactate acid production during competition.

References


