COORDINATION AND KINEMATICS IN 200 M FRONT CRAWL SWIMMING ALL OUT

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SUMMARY
The aim of this study was to compare coordinative and kinematics parameters along the four laps of a 200 m front crawl stroke all out. Fifteen male swimmers performed a 200 m trial, all out, in front crawl. Index of coordination (IdC), swimming velocity (SV), stroke length (SL), stroke rate (SR) and stroke phase’s duration along the laps were measured and compared. Results were: SR increased while SL and SV decreased; IdC was in superposition and stroke phase’s duration were similar. Probably these results are related to the physiological environment along the 200 m and the attempt to keep the swimming velocity constant.

METHODS
Fifteen male distance swimmers (age: 21.1 ± 7.1 years old; height: 180.1 ± 6.1 cm; arm span: 187.3 ± 8.1 cm; body mass: 72.1 ± 10.1 kg) participated voluntarily in this study, which was approved by the local ethics committee.

Protocol
The 200 m trial was performed in a 25 m long pool (water temperature: 29.5 ± 0.7°C), in the same time of the day for every swimmers, between 2 and 6 PM; it was performed after a 800 m free swimming warm up and in maximal intensity, and without start from the block.

Data collection
Data acquisition was performed with manual time keeping and with 2D videogrametry system. For the hand timing system, a space of ten meters, from 10 to the 20 m of the lap, was marked. Three experienced timekeeper registered: time to swim the 10 m (head as the reference) and time to perform three consecutive and complete stroke cycles. Then, these data were used to calculate SV (10 m/time in sec to perform the distance), SR (3 cycles/time in sec to perform the three cycles) and SL (SV/SR). Images from the swimmer sagittal plane were obtained at 60 Hz from each lap before the 50, 100, 150 and 200 m respectively, L1, L2, L3 and L4) of the 200 m trial. Two camcorders (Sanyo) were positioned under and above water in an rigid arm fixed to a chariot which was over trails along the lateral swimming pool board. This chariot was pushed, in the same velocity of the swimmer, by an experienced researcher. Both cameras were focused to the swimmer shoulder and were, previously, synchronized with a light flash.

Data analyses
Stroke phases are determined as (for the same arm):
A. Entry and catch: time gap between the hand’s entry in the water and its first movement backward; no propulsive phase;
B. Pull: time gap between the hand’s first movement backward and its position just above the shoulder; propulsive phase;
C. Push: time gap between the hands position just above the shoulder and its released from the water; propulsive phase;
D. Recovery: time gap between the man released from the water and its entry in the water; no propulsive phase.

To determine the adopted coordination model it was used the IdC values proposed by Chollet, Chalies e Chatard [1]: IdC < 0% means catch up model; IdC = 0% indicates opposition model and IdC > 0% indicates superposition model. These models refer to time gap between the propulsive phases of both arms, specifically, catch up model: when the B phase of one arm starts before the C phase of the other arm finish; opposition model: there is no time gap between B phase of one arm and C phase of the other arm and superposition: B phase of one arm starts before the C phase of the other arm finish.
Statistical analyzes were performed with descriptive and inferential methods. Normality distribution was tested with Shapiro-Wilk Test and mean ± standard deviation were calculated. Among the kinematic, Repeated ANOVA was applied, sphericity was verified with Mauchly Test. When necessary, correction factor Epsilon of Greenhouse-Geisser was used. Main effects were verified with Bonferroni Test; α=0.05.

RESULTS AND DISCUSSION

Performance in 200 m front crawl was 130.7 ± 6.5 s, relative to 76.1% of the world record. Mean velocity was 1.53 ± 0.07 m.s⁻¹. Main results are in Table 1.

<table>
<thead>
<tr>
<th></th>
<th>L1</th>
<th>L2</th>
<th>L3</th>
<th>L4</th>
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</thead>
<tbody>
<tr>
<td>SR (Hz)</td>
<td>39.51 ±4.5</td>
<td>40.14 ±4.9</td>
<td>40.90 ±4.5</td>
<td>42.06 ±3.1†</td>
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<tr>
<td>SL (m)</td>
<td>2.18 ±0.15</td>
<td>2.06 ±0.14†</td>
<td>2.02 ±0.15†</td>
<td>1.97 ±0.15†</td>
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<tr>
<td>SV (m/sec⁻¹)</td>
<td>1.43 ±0.13</td>
<td>1.37 ±0.09†</td>
<td>1.36 ±0.07</td>
<td>1.38 ±0.09</td>
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<tr>
<td>IdC (%)</td>
<td>1.10 ±10.7</td>
<td>1.10 ±11.8</td>
<td>3.66 ±9.4</td>
<td>3.87 ±10.5#</td>
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<tr>
<td>Phase A (%)</td>
<td>26.11 ±10.7</td>
<td>25.38 ±11.6</td>
<td>24.55 ±11.4</td>
<td>23.2 ±10.9</td>
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<tr>
<td>Phase B (%)</td>
<td>27.1 ±8.2</td>
<td>27.06 ±9.2</td>
<td>27.48 ±8.3</td>
<td>28.4 ±8.6</td>
</tr>
<tr>
<td>Phase C (%)</td>
<td>23.48 ±3.1</td>
<td>23.57 ±2.9</td>
<td>24.34 ±3.3</td>
<td>24.61 ±3.0</td>
</tr>
<tr>
<td>Phase D (%)</td>
<td>23.38 ±3.3</td>
<td>23.17 ±3.3</td>
<td>23.13 ±3.5</td>
<td>23.26 ±3.3</td>
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† Significant differences to the lap L1 (p < 0.05). # Significant differences to the lap L2 (p < 0.05).

Table 1. Stroke rate (SR), stroke lenght (SL), swimming velocity (SV), index of coordination (IdC), duration of the four phases (A, B, C and D) of the strokes in the four laps (L1 to L4) of the 200 m front crawl; n = 15.

CONCLUSIONS

For the 200 m front crawl all out, four main conclusions are described: 1) there is an increase in SR and decrease in SL along the laps; 2) SV decreased just from the first to the second lap, than it has stabilized; 3) even that IdC has changed from the second to the last lap, it was always in superposition model; 4) there is no difference in the duration of the stroke phases.

REFERENCES