ARM MOVEMENTS AFTER A BACKSTROKE TURN

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While turning, a swimmer takes approximately one second to reverse his direction before he thrusts from the wall. However, the advantage gained from the thrust and the initial arm movements more than make up for the time it takes a swimmer to reverse his direction. This advantage explains why all short course records are faster than long course records.

PROBLEM

The most often advocated method is the alternate-arm pull. After the body is in a push-off position, the elbows are flexed, palms up, one on either side of the head close to the ears, just over the shoulders. A vigorous drive of the legs is made, while at the same time the arms are thrust out at full flexion beyond the head. The first arm pull is taken with the opposite arm remaining flexed. The second arm pull follows on cadence as the stroke begins (Armbruster, 63).

King (1957) found that the backstroke flip turn with a one-arm glide was superior to the backstroke flip turn with a two-arm glide. The arm which makes first contact with the side of the pool remains at the swimmer's side during the push-off and glide.

A third method, a double-arm pull, was used successfully by the East Carolina University swimming teams that were coached by Ray Martinez (1954-68).

PURPOSE

Analyze three different initial arm movements used after a backstroke turn.

Equipment

The Aquatic Swim Controller is capable of measuring accurately to $.07 \times 10^{-6}$ of a second and records accurately to .01 second.*

* Strandberg Engineering Laboratories Inc., Industrial Electronics Division, 1001 South Elm Street, Greensboro, North Carolina, 17406.

Three electronic switches were remotely connected to the Aquatic Swim Controller. Each assistant pressed the electronic switch when the head of the swimmer was first seen through the sighting device.

Three sighting devices were constructed of wood; the base was 24 inches by 5 1/2 inches. The front vertical support was 14 1/2 inches and the rear vertical support was 22 inches. A board connecting these supports was slanted at a 40 degree angle. A V-shaped viewer was placed at the highest point of the slanted board, and a nail was driven into the lowest point of the board.

FINDINGS

1. The double-arm pull method was significantly faster than the surrogate alternate-arm pull method at the .01 level of confidence for distances of 5, 10, and 15 yards.

2. The double-arm pull method was significantly faster than the alternate-arm pull method at the .01 level of confidence at a distance of five yards; they were not significantly different at 10 and 15 yards.

3. The alternate-arm pull method was significantly faster than the surrogate alternate-arm pull at the .05 level of confidence at a distance of 10 yards; they were not significantly different at 5 and 15 yards.

Discussion of findings

Our data does not agree with King's (1957) findings. At five yards, he found that a turn plus a thrust using the surrogate alternate-arm pull was superior to a turn plus a thrust using the alternate-arm pull. Because we did not include the turn in our study, there is the possibility that a turn can be performed faster when followed by a one-arm glide than when followed by a two-arm glide.

All subjects for all methods were slightly slower for the 5-10 yd. subinterval than they were for the 10-15 yd. subinterval. Possibly, the transition from the underwater to the surface swimming position had an adverse effect on velocity during the 5-10 yd. subinterval.

DEFINITION OF TERMS

Alternate-arm pull -- While the thrust is made, both arms are flexed at the shoulders. As the swimmer pulls backward with the first arm, the elbow starts to bend and reaches maximum flexion (approximately 90°) as the hand passes the shoulders. As the hand continues backward past this point, the elbow starts to extend and reaches full extension at the end of the downward push. The opposite arm pull follows in cadence (Counsilman, 1968).

Surrogate alternate-arm pull -- During the thrust from the wall, one arm is flexed at the shoulder, and the opposite arm is extended by the swimmer's side. The arm flexed at the shoulder starts and completes its pull before the opposite arm pull is started (King, 1957).

Double-arm pull -- Both arms are flexed at the shoulders while the thrust is made. Both arms pull at the same time. One arm is flexed at a

greater angle at the elbow so both arms will not be extended at the same time. The arm with the greater flexion at the elbow finishes the pull first and then continues the arm cycle. Leg movements should not begin until both arms have started the pull (Martinez, 1971).

PROCEDURE

Subjects were 11 male East Carolina University varsity swimmers. They were randomly placed into three groups (4, 4, 3), and a counterbalance rotation technique was used. During a week of practice and testing, each subject attended a daily standardized 20-minute instruction and practice session (Tuesday - Friday); rested for one day (Saturday); was tested (Sunday).

All swimmers performed 15 trial swims for each method. Times for 5-, 10- and 15-yard intervals were recorded (electronic timing) with three minutes of rest between trials.

Statistical analysis

The mean times in seconds for the double-arm pull were: 5 yds.-1.20; 10 yds.-4.54; 15 yds.-7.43. For the alternate-arm pull: 5 yds.-1.30; 10 yds.-4.59; 15 yds.-7.58. For the surrogate alternate-arm pull: 5 yds.-1.34; 10 yds.-4.72; 15 yds.-7.72.

For each distance investigated, an analysis of variance was used to determine the significance of differences. Scheffe was used for post-hoc comparisons.

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