Backstroke

Backstroke is an alternating swimming stroke involving both the arms and the legs. The arm movement consists of an underwater propulsive phase and an aerial recovery phase. The legs play a dual role: propulsion and, above all, body balance and stabilization. (Lacoste & Semerjian, 1998, p. 47)

3.2.1. Body Position

The swimmer lies in a dorsal position in the water. To achieve an advantageous hydrodynamic position, the head is slightly raised toward the thorax so that the ears remain submerged. (Lewin, 1981, p. 85)

As in front crawl, body balance should be horizontal to reduce forward resistance. Maintaining good horizontal and lateral alignment is essential. Shoulder roll becomes more pronounced in backstroke to position the propulsive surfaces for maximum efficiency, despite joint limitations, and also to facilitate shoulder clearance during the recovery phase. This roll must be properly controlled to minimize resistance. Reducing the frontal surface area, improving body entry shape, and maximizing body length are key objectives. (Chollet, 1997, pp. 111–112)

3.2.2. Arm Movement

The arm technique in backstroke consists of four underwater sweeps and a recovery phase.

3.2.2.1 First Downward Sweep

Shoulder rotation places the hands so that the little finger enters the water first, with the palm facing outward. The elbow remains extended, and the swimmer adopts a stretched position to begin the underwater propulsion phase. Unlike front crawl or butterfly, the initial pushing component in backstroke is dominated by the latissimus dorsi, while the contribution of the pectoralis major is reduced. Nevertheless, both muscles remain the primary motor muscles and are involved to varying degrees throughout the propulsive phase. (McLeod, 2012, p. 5)

After water entry, the swimmer's arm performs a downward and outward sweep to establish the catch position. This occurs when the hand reaches its deepest and widest point. Following the catch, aided by shoulder rotation, the hand moves downward and outward with slight elbow flexion. This movement is primarily produced by shoulder rotation rather than a rigid arm press. The deepest point of the hand is between 45 and 60 cm, depending on body and shoulder roll. Elbow flexion helps prevent excessive lateral deviation of the hand. (Pedrolletti, 2000, pp. 136–137)

3.2.2.2 First Upward Sweep

The first upward sweep is the initial propulsive phase. It begins at the catch. The swimmer performs a semi-circular movement upward and backward. While wrist flexors remain active throughout propulsion, the wrist stays neutral to slightly extended. Due to water pressure and activation of the biceps brachii and brachialis, the elbow flexes to approximately 45° at the start of the pull and may reach 90° by the end of the phase. (McLeod, 2012, p. 5)

The aquatic pull begins once the arm reaches a depth of 20–30 cm. The elbow starts extended and progressively flexes as the arm moves backward, reaching a maximum flexion of 90–100° at mid-

pull (start of the push), then extending again toward full extension at the end of the push. During the pull, the upper arm undergoes medial rotation, placing the elbow in an “inverted high” position. (Counsilman, 1986, pp. 126–127)

3.2.2.3 Second Downward Sweep

The swimmer performs a second downward sweep, beginning when the hand reaches the highest point of the previous sweep. The arm follows a semi-circular path downward and backward until it is fully extended below the thigh. The hand, previously oriented upward, turns downward toward the pool bottom. Fingertips remain oriented laterally throughout the movement.

Hand speed decreases during the transition into this sweep, then progressively increases to reach maximum velocity at the end of the movement. (Maglischo, 2003, p. 193)

3.2.2.4 Second Upward Sweep

For many years, it was believed that propulsion ended with the second downward sweep. Recent findings show that swimmers can still generate propulsive force as the arm moves toward the surface.

From the end of the previous sweep, the swimmer performs an upward, backward, and inward sweep until the hand reaches the back of the thigh. Recovery begins from this point. The hand then moves forward and upward, and no further propulsion is produced.

During this sweep, the wrist is hyperextended so that the palm faces backward and slightly upward, while the fingers point downward. Hand speed decreases markedly during the transition, then accelerates to a maximum at the end of the movement. The wrist becomes the leading edge, while the fingers act as the trailing edge, directing water backward and downward. Not all swimmers use this phase for propulsion; some initiate recovery immediately after the second downward sweep. (Maglischo, 2003, p. 194)

3.2.2.5 Relaxation, Recovery, and Water Entry

The aerial recovery begins while the hand is still in the water. At the end of the push, the swimmer presses water downward, causing body roll and elevating the shoulder on the same side, which facilitates arm exit. The palm then turns toward the thigh, thumb upward, and the hand exits led by the thumb. Recovery is performed with the elbow fully extended, with the arm swinging vertically upward and forward. (Counsilman, 1986, p. 122)

Pressure on the water should be released near the lower thigh. The hand turns inward and exits edge-first to minimize drag. The thumb exits first, not the little finger. Hand speed decreases significantly during recovery. Continuous shoulder roll assists arm exit with minimal effort.

The arm moves upward and forward above the water, remaining high to avoid lateral body deviation. The palm faces inward during the first half of recovery and outward during the second half. Recovery should be quick yet smooth, with muscles as relaxed as possible.

Water entry occurs with full arm extension directly in front of the shoulder, palm oriented outward to minimize turbulence. (Costill et al., 1994, p. 93)

3.2.2.6 Arm Synchronization

Unlike front crawl, where several coordination patterns may be effective, backstroke requires opposition coordination. Shoulder anatomy necessitates significant upper-body roll to enhance propulsion and facilitate opposite-arm recovery. In this coordination, when one arm reaches the highest point of recovery, the other begins its final underwater sweep. Hand entry of one arm occurs as the opposite arm completes its final sweep. (Chollet, 1997, p. 113)

3.2.3. Leg Kick

The backstroke kick combines characteristics of front crawl and butterfly. Like crawl, the kick is alternating, but due to the swimmer's dorsal position, most propulsive force is generated during the upward phase rather than the downward phase. Dolphin kicking is also used after starts and turns. Muscle activation patterns are similar, with directional differences due to body orientation. (McLeod, 2012, p. 5).

3.2.3.1 Upward Kick

The upward kick is a whip-like extension beginning with hip flexion, followed by knee extension, and ending with partial ankle flexion. The kick starts as the foot passes under the hips during the preceding downward kick. The thigh rises as the lower leg and foot remain relaxed, allowing water pressure to flex the knee and plantar-flex the ankle.

The thigh continues rising above hip level, after which the leg extends diagonally upward toward the surface until fully extended just below the water. Legs are more flexed during the upward kick in backstroke than during the downward kick in crawl, enhancing propulsion. (Costill et al., 1994, p. 94)

3.2.3.2 Downward Kick

The downward kick is a rebound-like action following the upward kick. The leg glides downward in extension, with the foot in a neutral position maintained by water pressure. The movement ends when the leg passes beneath the body, at which point hip flexion begins the next upward kick. (Costill et al., 1994, p. 94)

3.2.4. Arm Leg Coordination

Coordination between arms and legs occurs naturally through action–reaction mechanics. During the second half of the underwater arm movement, the hand pulls the hip on the same side. To counter lateral oscillation, the swimmer performs an upward kick with the opposite leg, canceling rotational torque. (Counsilman, 1986, p. 131)

Six kicks per arm cycle are more consistent in backstroke than in crawl, with greater amplitude. Superimposing arm and leg diagrams helps illustrate synchronization. (Catteau & Garoff, 1986, p. 181)

3.2.5. Breathing

Breathing difficulties are minimal compared to other strokes, as the mouth and nose are usually above water. Breathing rhythm is linked to arm movement. Inhalation occurs through the mouth, exhalation through the mouth and nose. Typically, swimmers inhale during the recovery of one arm and exhale during the recovery of the other. This pattern prevents breathlessness and shallow breathing. (Lewin, 1981; Counsilman, 1986).

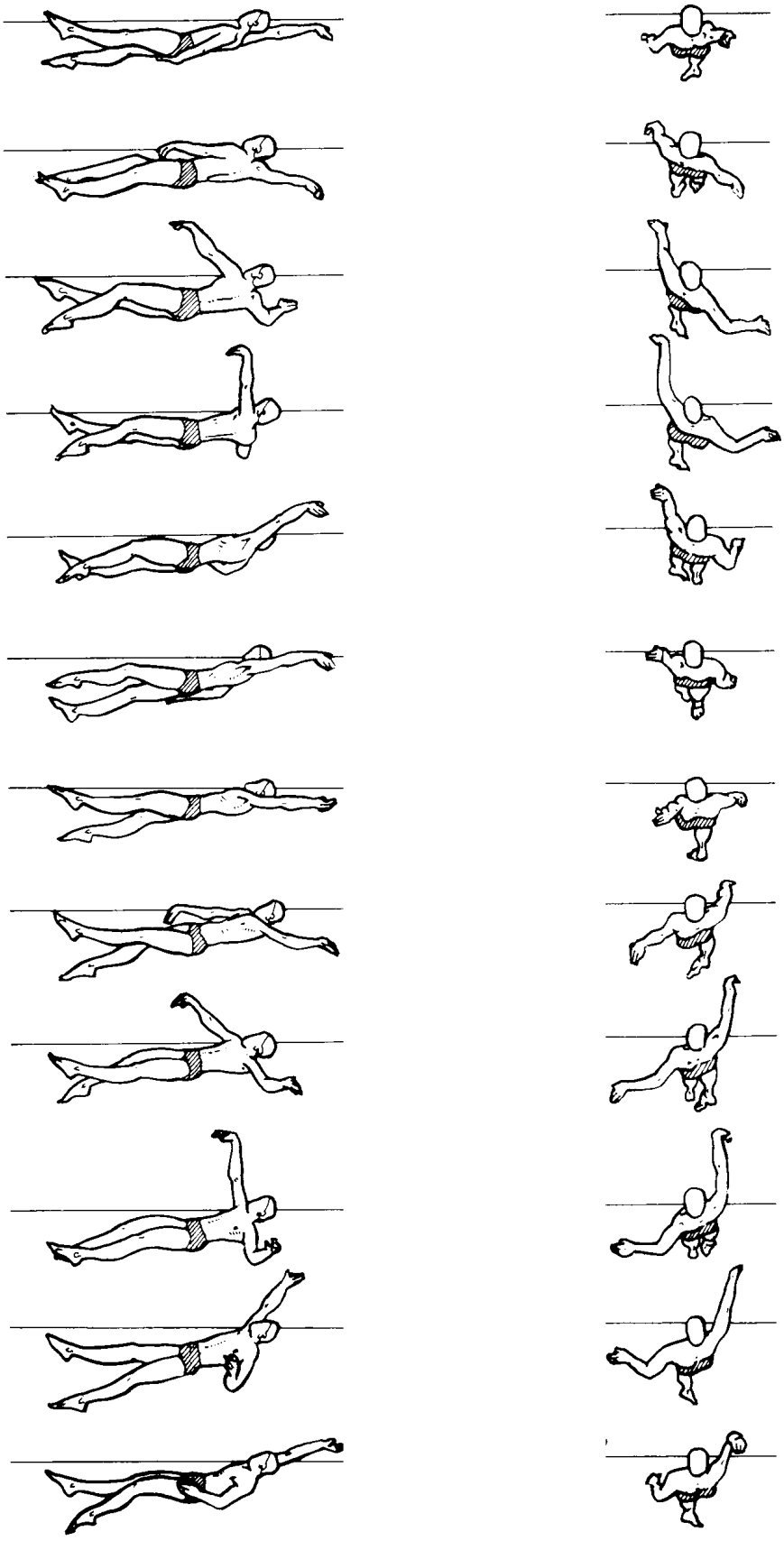

Figure 2: Illustration of Backstroke Technique