Front Crawl (Freestyle)

This swimming style is better known as **"freestyle."** In official regulations, crawl as such does not exist; the term used is *freestyle*. It was coaches and swimmers who chose the crawl technique as the fourth stroke because it remains the most efficient and the fastest style (Refuggi & Chifflet, 1998, p. 78).

In freestyle events, contrary to what one might believe, there is in fact no real choice: if one wishes to be efficient and competitive, one swims crawl. This is why crawl has become synonymous with freestyle. There is no official regulation governing crawl itself; the regulations established for freestyle prevail.

Freestyle means that in an event designated as such, the swimmer may use any swimming style, except in individual medley or medley relay events, where freestyle refers to any style other than backstroke, breaststroke, or butterfly (Lacoste & Semerjian, 1998, p. 57).

1. Body Position

The body must be balanced in a horizontal position in order to reduce resistance to forward motion. It is important to maintain good horizontal and lateral alignment, as well as sufficient shoulder roll, while limiting lateral and frontal oscillations of the rest of the body.

The body surface perpendicular to the direction of motion should be as small as possible. The form of water entry must also aim to reduce resistance to forward motion. Maximum body elongation is another factor that promotes propulsion.

The reference position is prone (ventral), insofar as human joint capabilities allow upper-limb movements in the anterior plane that are far more effective than those performed in the posterior plane of the body (Chollet, 1997, p. 106).

2. Arm Movement

The underwater arm movement in front crawl consists of three diagonal sweeps: a downward sweep, an inward sweep, and an upward sweep. The entry and extension, as well as the release and recovery, will also be described.

2.1 Entry and Extension

The swimmer immerses the hand, then the wrist and elbow, into the water and extends the arm into the initial position of the propulsive phase. Upward rotation of the scapula allows the swimmer to reach an elongated position in the water (McLeod, 2012, p. 3).

This action conditions the entire movement. The elbow, positioned ahead of the head, effectively guides hand entry and extension with minimal turbulence. Extension occurs along the body's axis during the final part of the propulsive movement of the opposite arm. It allows body stabilization and the transmission of velocity (Pedroletti, 2000, p. 108).

Entry occurs directly in front of the swimmer's shoulder, with the elbow slightly flexed and the palm facing outward. This allows the hand to slip into the water on its edge, followed by the arm entering nearly the same portion of water.

A bow wave is produced if the swimmer pushes the hand forward through the water during entry. Conversely, a streamlined entry minimizes this drag. Swimmers must ensure that their hand does not cross in front of the face during entry, as this would cause lateral body oscillation. Instead, the hand should enter somewhere between the midpoint of the head and the top of the shoulder on the same side.

After entry, the arm is extended almost straight forward just beneath the water surface. During arm extension, the palm faces downward (Maglischo, 2003, p. 103).

2.2 Downward Sweep and Catch

The downward sweep should begin immediately after the propulsive phase of the opposite arm has ended. The lead arm performs a curvilinear downward sweep until the moment of the catch.

The swimmer gradually flexes the elbow during the downward sweep in order to bring the arm directly backward at the moment of the catch. This occurs near the end of the sweep when the elbow is positioned above the hand and the arm and forearm are oriented backward (Costill et al., 1994, p. 66).

Following the catch, the hand gradually accelerates while moving downward and slightly outward with a slight elbow flexion. The relaxed hand takes a spoon-like shape. The palms are oriented downward, outward, and backward. This sweep is the least propulsive, but it is decisive in positioning the arm and hand optimally for the sculling action that follows (Pedroletti, 2000, p. 108).

The hand is inclined so that the palm faces diagonally outward. If the hand were held flat during entry, the mass of air bubbles dragged along would be so great that underwater pulling efficiency would be compromised. Therefore, the hand must be held at an angle of approximately 45° relative to the water surface, with the thumb leading the entry. This minimizes air entrainment (Counsilman, 1986, p. 104).

The movement is initiated by the clavicular portion of the pectoralis major, rapidly assisted by the latissimus dorsi. These two muscles generate most of the force applied during underwater arm traction, particularly during the second part of the movement. Wrist flexors maintain slight wrist flexion throughout the propulsive phase. Elbow flexors (biceps brachii and brachialis) contract at the beginning of the catch phase and progressively bring the elbow from full extension to approximately 30° of flexion (McLeod, 2012, p. 3).

2.3 Inward Sweep

Upon reaching the deepest point, the hand movement curves around the wrist, orienting the palm inward, upward, and backward. The trajectory following the hand also curves inward, upward, and backward. Hand speed accelerates until it aligns with the body’s longitudinal axis (Pedroletti, 2000, p. 110).

According to Counsilman (1986, pp. 104–106), any conception of a straight-line underwater arm trajectory must be rejected. Photographic analysis of numerous swimmers shows that the arms never follow a perfectly straight path but instead describe a sinuous curve.

Some swimmers use a variation resembling an S-shaped trajectory. The amplitude of the curve varies among swimmers, likely depending on strength, flexibility, or other factors. Another misconception must be dismissed: elbows should not remain fully extended during the entire propulsive phase. In fact, the arm flexes at the elbow to varying degrees throughout most of the movement.

The outward sweep illustrated in Figure 21 is the first propulsive movement in crawl. It is also semicircular, beginning at the catch and continuing until the arm reaches the body's midline or slightly beyond. The arm, flexed at the catch, flexes further during the inward sweep to reach approximately 90° at the end. The palm gradually turns inward and upward by the end of the movement.

Swimmers should moderately accelerate their hands from the beginning to the end of the inward sweep. However, maximum hand speed should not be reached at this stage, but rather during the following phase (Monteil & Rouard, 1994, p. 57).

2.4 Upward Sweep

Under the chest, the palm initially turns outward and backward. Subsequently, it turns upward and outward as it disengages from the body. Following the arm sweep, the arm extends and externally rotates while moving upward and outward (Pedroletti, 2000, p. 110).

The upward sweep is the second and final propulsive sweep in crawl. It begins at the end of the preceding sweep. Orientation shifts rapidly from inward to outward by rotating the hand. The swimmer moves the arm upward, outward, and backward toward the surface. The upward sweep ends when the hand reaches the level of the thigh—not the water surface. The arm extends during this sweep, but not fully, contrary to a widespread belief. Hand speed reaches its maximum during this movement (Costill et al., 1994, p. 68).

During the final part of the propulsive phase, the triceps brachii extends the elbow, bringing the hand backward and above the water, thus concluding the propulsive phase. The degree of elbow extension depends on swimming technique and the timing of arm exit (McLeod, 2012, p. 3).

2.5 Release and Recovery

The release phase begins before the swimmer's hand exits the water. It starts when the elbow emerges during the upward sweep. At this point, the swimmer begins flexing the arm to bring it forward while the hand is still underwater.

The overlap between the end of the upward sweep and the beginning of recovery preserves angular momentum and reduces muscular effort needed to overcome arm inertia and redirect it forward. Pressure should be released as the hand crosses the thigh (with the elbow already out of the water). The palm turns inward so that the hand presents its edge to the water surface, minimizing resistance.

Once out of the water, the arm is brought forward for the next cycle using the traditional high-elbow recovery. Progressive elbow flexion allows the arm to continue moving upward and forward after leaving the water and prevents excessive lateral swing. Although the arm naturally tends to swing outward in a circular motion, swimmers must concentrate on directing it as straight forward as possible. Excessively low or wide recovery disrupts body alignment.

Body rotation is also essential for effective recovery. Swimmers must rotate toward the recovering arm so that the shoulder on that side is higher, facilitating high elbow position and a straighter forward arm path.

The goal of recovery is to position the arm for the next cycle. It is an important but non-propulsive function. Recovery should return the arm above water without disturbing lateral alignment and allow temporary muscular relaxation. Swimmers should use minimal force and focus on accelerating the propulsive phase rather than recovery. Recovery speed will naturally adjust to match the opposite arm, preventing energy waste and alignment disruption (Maglischo, 2003, p. 113).

The transition between the end of the push and the recovery occurs as the hand changes orientation. Momentum gained during underwater traction and push continues seamlessly into recovery. At the end of the push, the palm faces directly backward, then rotates inward toward the thigh. The little finger exits the water first, followed by the hand slicing vertically through the surface like a knife, minimizing resistance (Counsilman, 1986, pp. 101–104).

The primary muscles active during recovery are the deltoid and the rotator cuff (supraspinatus, infraspinatus, teres minor, subscapularis), lifting the arm and hand out of the water near the hips and overhead for the next entry (McLeod, 2012, p. 3).

2.6 Arm Synchronization

In crawl, arm movements are alternating: when one arm is propulsive, the other is in recovery. Several muscle groups act as stabilizers during both phases, the most important being the scapular stabilizers (pectoralis minor, rhomboids, levator scapulae, middle and lower trapezius, serratus anterior). These muscles stabilize the scapula, which is essential since propulsive forces depend on solid scapular support. Scapular stabilizers also work with the deltoid and rotator cuff to reposition the arm during recovery (McLeod, 2012, p. 3).

Precise interrelations between the two arms are critical for swimming speed. Alternating arm movements must be coordinated with body rotation to facilitate the three sweeps and maintain a streamlined position. The most important event is that the lead arm should enter the water when the opposite arm is midway through the inward sweep. This allows body rotation toward the propulsive side in preparation for the upward sweep. Additionally, the lead arm must not begin the downward sweep until the opposite arm has completed the upward sweep (Maglischo, 2003, p. 115).

According to Chollet (1997, pp. 107–108), three main coordination patterns exist in crawl:

- **Catch-up coordination**: one arm pauses during the other's propulsive phase. This promotes body elongation but disrupts motor continuity.
- **Opposition coordination**: propulsive actions alternate like a relay; advantageous when supported by active leg action.
- **Overlap coordination**: partial overlap of propulsive phases. Often associated with reduced leg action and middle-distance swimming, offering energetic advantages but reducing the catch phase.

3. Leg Kick

The legs perform alternating regular kicks, passing close to each other. When aligned, they should extend roughly along the body's transverse axis so that propulsion acts on the center of gravity (Lewin, 1981, p. 80).

The entire leg is involved from hip to ankle. Toes should just skim the surface. Air bubbles facilitate movement. Although leg kicking is not highly propulsive, its quality greatly influences arm propulsion efficiency (Lacoste & Semerjian, 1998, p. 59).

Like arm movements, leg kicks include propulsive and recovery phases. The recovery phase begins at the hips with contraction of the gluteal muscles, followed by the hamstrings, functioning as hip extensors (McLeod, 2012, p. 3).

3.1 Downward Kick

The downward phase begins at the hips through activation of the iliopsoas and rectus femoris. The quadriceps assist knee extension, providing additional power (McLeod, 2012, p. 3).

This whipping movement starts with hip flexion followed by knee extension. The leg begins its downward kick before reaching the peak of the previous upward kick. Proper relaxation allows water pressure to rebound the leg upward before an active downward whip.

3.2 Upward Kick

At the end of the downward kick, the leg rebounds upward with the knee extended. Water pressure maintains leg extension and positions the foot naturally. The upward kick ends when the leg aligns with the body and the thigh begins hip flexion, initiating the next downward kick.

Throughout kicking, knee and ankle muscles remain relaxed except at the end of the downward kick, where strong extension and plantar flexion occur. Primary muscles involved are hip flexors and extensors (Costill et al., 1994, p. 71; McLeod, 2012, p. 3).

3.3 Kick Amplitude

Kick amplitude should be neither too deep nor too shallow. Optimal width ranges between 50 and 80 cm. Cureton (1930) recommended a maximum of 61 cm, while Allen (1948) found 36 cm superior to 15 cm for propulsion.

The kick must stabilize and propel without increasing drag. The foot should lightly break the surface during the upward kick; excessive height pushes the body downward. At the end of the downward kick, the foot should be just below the body line (Maglischo, 2003, p. 123).

4. Breathing

The need for oxygen forces swimmers to bring airways to the surface. Breathing should disrupt body balance as little as possible. Inhalation must be rapid, with the mouth wide open. Swimmers use the bow wave created by head movement, rotating rather than lifting the head (Catteau & Garoff, 1986, pp. 161–162).

The head should not be too high; a lower position improves hydrodynamics. Excessive head lift causes hip sinking and increased resistance. Inhalation occurs during a brief window when the mouth clears the surface; exhalation occurs underwater, slowly at first, then forcefully just before inhalation (Counsilman, 1986, pp. 114–116).

Breathing should occur during the first half of recovery, with the face returning to the water during the second half, coordinated with body rotation to optimize alignment for the upward sweep.

Most swimmers breathe once per stroke cycle on the same side. Some use bilateral breathing (every three strokes). While conventional breathing is recommended, especially beyond 100 m, some swimmers perform better with alternate breathing despite reduced oxygen intake (Costill et al., 1994, pp. 74–75).

In freestyle events from 50 to 1500 m, breathing patterns vary. Sprinters minimize breathing, while distance swimmers breathe more frequently, often every stroke before and after turns (Pelayo & Wojciechowski, 1991, p. 30).

5. Arm–Leg Coordination

Motor solutions for arm–leg coordination typically involve three rhythms: **six-beat**, **four-beat**, and **two-beat** patterns.

5.1 Six-Beat Kick

Each leg performs three kicks per arm cycle, totaling six kicks per cycle. Often used by sprinters, though some distance swimmers also use it (Counsilman, 1986, p. 121).

Each downward kick aligns with one of the three arm sweeps. Timing is precise, making this rhythm theoretically ideal, although elite swimmers succeed with other rhythms as well (Costill et al., 1994, p. 75).

5.2 Two-Beat Kick

Used by many swimmers, especially women. One kick occurs per arm stroke. Legs move almost straight up and down without crossing (Counsilman, 1986, p. 120).

This rhythm requires less energy and is common in distance swimming. Greater natural buoyancy reduces the need for strong leg action. Men often prefer four-beat or crossed two-beat rhythms to prevent leg sinking (Costill et al., 1994, pp. 75–76).

5.3 Crossed Two-Beat Kick

Primarily used by male swimmers. One leg crosses over the other during the kick, alternating sides. The crossing leg corresponds to the active arm. This rhythm suits swimmers whose legs tend to sink with a standard two-beat kick (Counsilman, 1986, p. 120).

5.4 Four-Beat Kick

A combination of six- and two-beat rhythms. Swimmers use six-beat kicking on one arm stroke and two-beat on the other. Many swimmers adopt a two-beat rhythm on the breathing side, possibly to facilitate inhalation (Costill et al., 1994, p. 76).

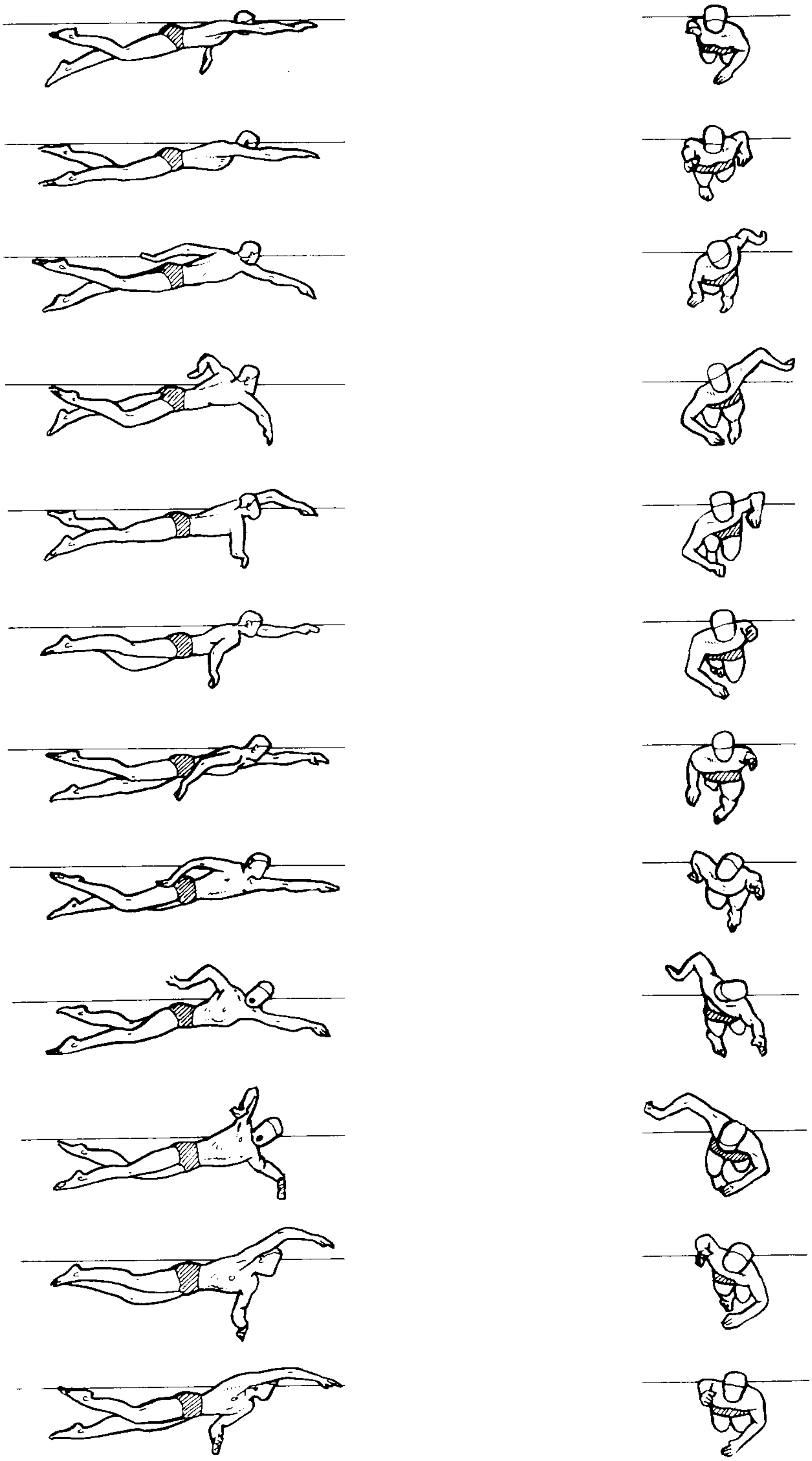

Figure No. 1: Illustration of the front crawl technique