CrossFitJOURNAL

Torpedo School 2: Learn to Turn

Minimizing time spent at the wall is essential to speed in the pool. By mastering open and flip turns, you can save energy and shave seconds off your lap times.

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June 2014



One of the simplest ways to improve times in the pool is to develop streamlines and turns.

Improving turns means reducing periods of zero velocity and accelerating more efficiently into the next length. Faster turns can shave seconds or minutes off race times, depending on the distance.

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Turns are relatively easy to practice, meaning athletes can perform many repetitions without fatigue, and at some point the swimmer will be forced to turn many times during normal practice sessions anyway. The correct attitude is to look at each turn as an opportunity to improve upon the previous one.

Great turns can have a dramatic effect on race performance. Observe the third heat of The Pool event at the 2013 Reebok CrossFit Games (footage available outside U.S. only). If you pay attention to experienced swimmers Matt Chan and Jordan Troyan, you may notice how their use of the flip turn allows them to accelerate back to race speed efficiently following the turn.

Troyan, an All-American swimmer at West Chester University, used a flip turn throughout the event and was able to use a powerful push to streamline about a third of the 25-yard pool. He won the event by more than 20 seconds, and observing his timing and technique will help you improve your own turns in the water.

Common Elements

While not actually part of the turn itself, push-offs and streamlines recur throughout races, not just at the start, so we'll go into a little more detail here.

The Push-Off Position

Whether you are using an open turn, flip turn or just pushing off the wall to start a set, the push-off position puts the body in an optimal posture to generate the most power coming off the wall. It resembles a half tuck (a squat) with the arms outstretched in an overhead (streamline) position while lying on the back or on the side.

One way to think about the push-off position is to imagine performing a squat jump toward an object high above your head. In the water, pretend you are jumping horizontally through a tube into a tight streamline. As you are doing so, consider a line created by the feet, hips and back. When trying to jump as high as you can on land, the three will ideally create a line parallel with the direction of travel.



The push-off position resembles an overhead squat in some ways and is designed to generate power.

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Streamline

As discussed in the article Torpedo School, drag and basic hydrodynamics require swimmers to streamline their bodies for best performance. The streamline position requires the athlete have some basic shoulder and scapular mobility.

A solid goal is to be able to push off the wall and glide in a streamline for at least 6 yards without the aid of any kicking before coming to the surface. For reference, most pools string backstroke flags across 5 yards (5 m for longcourse pools) from either wall.

In a future article, we will go into greater detail about the mechanics of underwater swimming and how to optimize it.

Types of Turns

The primary goal in any turn should be to maintain as much velocity as possible both into and out of the turn.

Imagine throwing a tennis ball into the wall. In a perfect world, the tennis ball rebounds to transfer momentum in the opposite direction. Clearly, this is impossible for a swimmer, and doubly so when considering the physical constraints we are dealing with in the water. However, the tennis-ball example illustrates that the athlete should focus on accelerating into the wall and then exploding back into the race.

There are two main types of turns that allow athletes to transfer momentum off the wall: the open turn and the flip turn.

Open Turns

Open turns are primarily used during butterfly, breaststroke or individual-medley races. In the case of butterfly or breaststroke, a swimmer must perform each turn with both hands touching the wall simultaneously. An open turn may be used for freestyle or backstroke races if the athlete is not comfortable with flip turns, but doing so is not at all optimal. The following steps explain how to effectively perform an open turn:

1. Touch— If your timing is on point, you should make first contact with the wall in between the end of one stroke cycle and the start of the next, when velocity is highest. The fingers, then the palm should touch the wall. The



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Contact the wall with arms outstretched, and flex the elbow on contact.



Bring the feet to the wall and drop one elbow below and behind you.

arm should not be rigid but rather allowed to flex, thus preparing you for the next step in the turn. For breaststroke or butterfly races, current Fédération Internationale de Natation (FINA, the governing body for international swimming competition) rules require wall touches with both hands on the turn and at the finish. If performing open turns while swimming freestyle, athletes may touch with one hand. Transitions between backstroke and breaststroke during individual-medley races are beyond the scope of this article.

2. Press and tuck—Upon touching the wall with a slightly bent elbow or slightly bent elbows, press away with your hand or hands at the contact point and simultaneously bring your knees to your chest. The intent is to very



Press away with the arms and bring the knees to the chest.



The ideal torso position is horizontal as you push off the wall.

quickly decelerate and prepare to continue the race off the wall; i.e., athletes should accelerate into the turn. A very fast turn, from touch to push-off position, should last no longer than a full second under ideal circumstances.

3. Roll and plant—If you performed Step 2 correctly, you will notice the tendency is for the body to roll backward naturally. Plant your feet on the wall as you roll backward and allow the elbow of your non-dominant arm to drop behind you. To prepare to streamline, simultaneously bring your opposing arm overhead close to your body. The ideal position is for your torso to be horizontal as your feet plant on the wall. To complete the turn, roll to the prone position, facing the bottom of the pool, as you extend the legs and ankles powerfully.

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Common Faults

One of the most difficult aspects of the open turn, particularly in breaststroke or butterfly races, is proper timing between touching the wall and the final stroke cycle coming into the wall. This can be challenging even for world-class athletes and requires a lot of practice.

For a perfect turn, you should make contact with the wall at full extension. If you're too far from the wall at full extension, this can mean a relatively long glide time, which creates the tendency to want to take an extra stroke before beginning the turn. The relative deceleration from the extra stroke cycle can be detrimental depending on the situation.

As a general rule, the streamline is a hydrodynamically optimal position for our bodies in the water. So you will need to make a judgment call if given the option to introduce drag into an optimal position when approaching the wall. In some cases, a half or quarter stroke length can provide more speed that balances the increased drag, but in many others it's faster to just glide for a second-and-a-half longer. More often than not, the correct answer is to glide, but this is not always the case.

A perfect example is the men's 100-m butterfly final at the 2008 Olympics in Beijing. Michael Phelps out-touched Milorad Cavic to win the gold medal by one-hundredth of a second after taking an extra half stroke above the water at the finish. There is little doubt Phelps made the correct decision to accelerate his hands above the water into the finish. But what if Cavic had not raised his head prior to the finish? What if Phelps had glided rather than halfstroked into the finish? I would argue the outcome may have been different and Cavic's time would have been a few hundredths faster.

When developing body awareness in the water, it is not uncommon to have athletes with incorrect foot placement push off with a steep angle relative to horizontal—which is inefficient. The goal is to push off as close to parallel with the surface as possible. As a guide for depth, your knees should be at or just below the surface when bringing them to the chest. This will allow for optimal foot placement immediately following the tuck. If the turn is performed correctly, you will leave the wall approximately one to two feet below the surface.

Foot placement is very important on turns, and some athletes will put themselves too close to the wall. To maximize efficiency at the push off, the knees should be



Touch.



Press and tuck, part 1.



Press and tuck, part 2.

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Roll and plant.



Streamline.

bent enough to facilitate a strong push without sacrificing quickness. If you are too close to the wall, the push will demand excessive knee flexion, which is an error. Anything past a 90-degree knee bend will decrease the power of the push.

One bad habit that occurs in both new and experienced swimmers is grabbing the gutter or side of the pool at the surface when performing an open turn. This is problematic for two reasons. First, in an officiated meet, the gutters are often covered by large starting pads. This can come as a shock to somebody looking to grab the wall during a turn and suddenly finding a flat surface. This can really throw off your race, so the best policy is to practice the way you will race. Second, grabbing the wall can lead to pulling the body into the turn, resulting in a longer transition time between turns and an overall slower race. If the focus is on accelerating into and out of a turn, we want to minimize contact with the wall as much as possible.

The solution to this problem is placing the hand flat on the wall without grabbing it or always touching the wall below the surface in a pool with low gutters.

Drills and Corrections

This 2-1-0 drill teaches a traditional open turn that can be used for all strokes except backstroke. If you do not feel comfortable doing flip turns, this turn can be used for freestyle but then only requires a one-arm grab of the wall.

When grabbing the wall with straight arms, employ a light flutter kick so the legs stay afloat. On "two," swing the legs forward as if you are attempting a back flip. On "one," bring one arm to your side in a rowing motion. Remember, you will turn toward whichever arm is brought back at this stage. On "zero," the arm still on the wall will come back toward your ear and then extend overhead as you roll to face the bottom of the pool. Slide your arms together into a tight streamline while exploding off the wall.

The Flip Turn

Flip turns are used in both the freestyle and the backstroke, combining a quick flip with a push-off. The flip turn is significantly faster than the open turn taught early in competitive swimming.

It's important to constantly exhale through the nose while performing a flip turn. There will likely be an uncomfortable burning sensation of water going up the nose. To better prepare for it, go to the bottom of the pool and face the surface of the water while practicing exhaling through both the mouth and nose. When you're comfortable with this, practice front flips in the water.

Flip-Turn Progression

This basic progression can be performed with the aid of a few pieces of inexpensive equipment and is very effective for novice swimmers attempting to learn the flip turn. The photos on pages 8 and 9 show an athlete using pull buoys as flotation aids, but athletes can also hold both ends of a foam noodle or any pair of objects that have some buoyancy.

There is a strong tendency for new swimmers to lift the head when approaching a turn; i.e., searching for the wall. The method described here helps swimmers

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Practice makes perfect, but the T on the bottom of the pool can give you a clue as to when to initiate the turn.



Initiate the flip.



Move the feet to the wall and move the arms toward the streamline position.



A squat deeper than the one pictured above is not an optimal pushing position.



Rotation starts when the feet contact the wall and continues during the push.



Rotation continues as the athlete snaps into a streamline position to minimize drag.

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develop a strong flip turn without the use of their hands and arms while also reinforcing a lower head position in the water. It also effectively engages the core, thereby shortening the transition to the push-off position. This is a six-step process:

1. Standing front flip—Hold two pull buoys with the hands behind the body while standing in the shallow end of the pool. Initiate the front flip by bringing the knees to the chest and tucking the head. The arms should be behind or to the side of the athlete during this movement. The goal is to be able to flip quickly and without altering the axis of rotation.

If you're having difficulty with front flips in the water, the flip may be practiced on a padded mat out of the water. Sit on the knees on a padded surface, tuck chin



Start with buoys held behind you.

to chest and begin a forward roll, allowing the feet to plant on the mat at the finish. You should finish with knees bent approximately 90 degrees and feet on the mat. The key is to roll in a straight line while throwing the legs over.

2. Buoys out front—The next step involves the wall. Starting at the flags, hold the buoys in front in a loose streamline while kicking. In a standard competition pool, a dark, contrasting line ending in a T 2 m from the wall can serve as the cue for a swimmer to discontinue strokebreathing mechanics prior to the turn. However, despite this standard, not all pools are built to spec, and some have wall indicators closer to or further from the wall. When the buoys contact the wall, flip. As the feet touch the wall, push off on the back with the arms extended



Exhaling through the mouth and nose can reduce the burning sensation of water going up the nose.



To initiate the flip, bring the knees to the chest and tuck the head.



If possible, avoid altering the axis of rotation.

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above the head. Progress to the next step as you become more comfortable with timing.

3. Buoys at hips—In this step, you will push off the wall on the back again. Begin by holding both buoys down at the sides with the body horizontal at the surface. Kick from the flags into the wall while watching for the T on the bottom of the pool. Some practice will be required to determine the timing, which will also depend on your velocity coming into the wall. A good rule of thumb is to begin the flip slightly more than a half body length from the wall itself, or as the body is passing the T. Again this may vary depending on the pool and the athlete. If the timing is correct, you should push off the wall on your back, holding the buoys in a loose streamline.

4. Arms down and kick—This step is similar to the previous except the pull buoys are absent. From the flags, kick with the arms at the sides. You should now be comfortable with the timing of the flip. After you flip, snap the arms into a streamline position and push off the wall on your back. As when practicing underwater push-offs, the back should be parallel to the surface and you should explode off the wall past the flags in a streamline with a strong, steady kick.

5. One-Two-Flip—Begin with arms in the streamline position and kick toward the wall. When the head is over the T, pull one arm and then the other down quickly and flip. The idea is to mimic the final stroke prior to the turn while swimming freestyle. You should explode off the wall on the back in a full streamline.

6. Full freestyle turn—The full turn will now incorporate two final elements: swimming into the wall and incorporating the twisting motion that allows you to push off the wall and transition back to full freestyle. Starting at or just past the backstroke flags, swim freestyle into the wall while watching the T for timing. The number of strokes needed after the T will depend on the size, strength and speed of the swimmer, as well as exact distance of the T from the wall. Most experienced adult swimmers require a single arm stroke after the T. The previous steps should give you clues as to exact stroke timing.

Less experienced athletes should begin by performing the turns slowly. Rushing into a turn too quickly will be problematic (and potentially painful; see below). For the twist, the direction of rotation is personal preference, but it is common to rotate toward the non-dominant arm.



Holding two pull buoys in front, kick toward the wall while watching for the T on the bottom of the pool.



With the buoys at the hips, kick into the wall, again watching for the T.

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Rotation should begin as soon as the feet plant on the wall, but you do need to be completely prone prior to leaving the wall. Most athletes continue rotation during the underwater portion of a turn, but you should be completely prone prior to the breakout or transition from underwater to surface swimming. Focus on keeping the body tight and in line as you explode off the wall to begin the underwater portion of the swim. As in the open turn, you should leave the wall approximately 1 to 2 feet below the surface and parallel to it.

Common Faults and Corrections

Newer athletes may struggle with a few elements of the flip turn. If it isn't practiced enough, the flip itself can be somewhat disorienting, and it is not uncommon for athletes to flip and then push off every way but perpendicular to the wall. This is especially problematic when multiple swimmers are in a lane in which people are circle swimming. To correct the problem, isolate the flip itself, focusing on rotating as straight as possible and planting the feet on the wall as close to perpendicular as possible.

A bad habit developed by less experienced swimmers

and displayed by a number of athletes at the 2013 Games is the lifting of the head prior to initiating the flip. Lifting the head increases drag dramatically and greatly decelerates the athlete as he or she goes into the turn. This is not what we want. The corrective action is to program short sets of 25s or 50s in which you will take four to six strokes, flip, and then continue swimming, repeating the pattern as many times as possible before reaching the wall. The focus here should be on keeping the head down. Next, practice turns with the emphasis on keeping the head in the water before turning.

Another common problem is determining proximity to the wall and when to initiate the flip. If you are too close to the wall, either the heels will hit the deck or you will end up in a very deep push-off position that is not optimal. On the opposite end, if you're too far away, you may miss the wall altogether or get a very weak push resulting from being at nearly full extension after the flip. In either case, reinforce correct timing by repeating steps 5 and 6 of the flip-turn progression above. Alternatively, the issue may correct itself as you become more comfortable performing flip turns—but intervention by a coach might be needed.



In this photo, the athlete is too close to the wall and will not be able to generate maximum power.

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By minimizing time on the wall and generating a powerful push, you can dramatically reduce swim times and increase efficiency.

Save Time—and Energy

Coaches and elite swimmers everywhere know practicing perfect turns and streamlines is one of the simplest ways to improve times and efficiency in the pool. Every athlete should strive to be able to flip turn, as it is the fastest way to switch directions off a wall.

Effective streamline technique allows the athlete to maintain speed coming off a wall and to reduce the amount of energy spent actually swimming. There is a dramatic difference between an athlete who has spent time developing and improving the turn and one who has not.

About the Authors

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