Sport-Specific Training for a Competitive Freestyle Sprint Swimmer

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ABSTRACT

SPORT-SPECIFIC STRENGTH TRAINING FOR SWIMMERS IS ACHIEVED BY PERFORMING EXERCISES THAT STIMULATE THE SAME MUSCLES IN THE SAME MANNER AS THE SWIM. SPORT-SPECIFIC EXERCISES CAN HELP INCREASE STRENGTH, POWER, AND BODY CONTROL AND DECREASE THE RISK OF SHOULDER INJURIES. WHEN 100TH OF A SECOND COULD DETERMINE FIRST TO THIRD PLACE, THE PURPOSE OF THIS ARTICLE WAS TO DEVELOP A SPORT-SPECIFIC STRENGTH TRAINING REGIMEN FOR A COMPETITIVE FREESTYLE SWIMMER.

“...in competitive swimming races, 100th of a second difference could determine the winner (3).” A swimmer primarily focuses on muscular strength and power within his/her strength training regimen. Each race has 3 main components: the start, the turn(s), and the swim itself - in a 50-m swim there is only one turn. The contribution of each component in a 50-m freestyle race includes the start approximately 20.5% (9), the turn approximately 30% (4), and the swim approximately 49.5%. With half of a 50-m freestyle race consisting of power and explosive movements and the other half consisting of strength and technique, the purpose of this article was to develop a swimming-specific strength training regimen. Freestyle swimming is generally known as the fastest stroke in swimming (7). With proper technique, the swimmer's body will lay on the surface of the water with his/her eyes down and his/her shoulders, hips, and ankles breaking the surface of the water. As the swimmer moves through the water his/her head will face the bottom of the pool, whereas his/her abdominal (shoulder to hips) and lower (lip to ankle) regions will roll side to side. As a swimmer reaches his/her arm forward rolling to one side and catching water, he/she will engage his/her deltoid, triceps brachii, trapezius, latissimus dorsi, abdominals, serratus anterior, supraspinatus, subscapularis, infraspinatus, and teres minor muscles. As a swimmer rolls to the other side pulling the water behind him/her, he/she will engage his/her deltoid, triceps brachii, latissimus dorsi, and abdominals. Throughout both of those movements, the legs will continually be kicking engaging the abdominals, gluteus maximus, gluteus medius, quadriceps, hip flexors, hamstrings, and gastrocnemius. Freestyle swimming is generally known as one of the fastest strokes but only if the swimmer can control these movements from the abdominal region.

Muscle strength and power are important aspects of a swimmer’s training regimen for success in his/her races. Freestyle is 1 of the 4 competitive strokes used by swimmers across the world. Figure 1 illustrates the primary muscles (shoulders, chest, and legs) and supporting muscles (arms, core, and calves) used while swimming freestyle. With proper strength and technique, the upper body is raised to the top of the water (Figure 2), guiding the body through the water speeding up or slowing down the swimmer as desired. Without proper strength and technique, the body sits lower in the water (Figure 3) creating more resistance and increasing the risk of injuries. By including sport-specific strength exercises to a swimmer’s training regimen, his/her strength, power, and technique will likely increase in a balanced manner.

Sport-specific training for swimmers can be achieved when performing exercises that stimulate the same muscles in the same manner as they swim. Sport-specific training may include the weight room, pool, body weight, or rubber tubing. In a 2007 study, 21 competitive swimmers were randomly assigned to 1 of 3 groups: strength group, resistance and assisted sprint group, and a control group. After 12 weeks, the only group that showed improvements in all 3 areas of swimming performance, technical parameters, and muscular strength was the resistance and assisted sprint group (2). This study demonstrates how sport-specific strength training can improve all components of a swimmer’s race and not just 1 or 2 components (2).

KEY WORDS:
sport-specific strength training; swimming; freestyle
Several studies have demonstrated that sport-specific strength training has contributed to improvements in shoulder health, strength, and power as well as a decrease in shoulder injuries (1,2,4,6,8). An average competitive year round swimmer will perform approximately 2,500 shoulder rotations per pool workout with shoulder injuries occurring in 47–80% of all competitive swimmers (8). Exercises that strengthen the supraspinatus, subscapularis, infraspinatus, and teres minor can help to reduce the risk of shoulder injuries. Ramsi et al. (5) assessed the internal and external rotator muscles of the shoulder pre-, mid-, and postseason of 27 competitive high school swimmers. They demonstrated an increase in both internal and external rotational strength from preseason to postseason. They concluded that imbalances in the internal and external rotation strength ratio could contribute to shoulder injuries (5). Temple University conducted a 6-week study (6) investigating ways to add sport-specific exercises to increase stability of the muscles surrounding the glenohumeral joint and decrease shoulder pain. They discovered throughout their study that the sport-specific training group had 40% less shoulder injuries than the non–sport-specific training group (6).

The start and turn components of a 50-m freestyle race combined consume 50.5% of the event time (4,9). During a start, a swimmer must generate impulse and power through triple extension of his/her hip, knee, and ankle joints off the block, entering the water in a tight streamline (arms locked past the head, overlapped hands, and biceps squeezing the ears) position prepared to maintain a kick before reaching the surface of the water. During a turn, a swimmer must forcefully extend his/her hip, knee, and ankles off the wall parallel to the bottom of the pool, maintaining the same streamline position as in the start and performing a kick before reaching the surface of the water. Plyometric training primarily focuses on acceleration and explosiveness of the muscles by "activating muscle switches from rapid eccentric muscle action [deceleration] to rapid concentric muscle action [acceleration] (4)." A 12-week study (8) completed in 2011 demonstrated how adding a plyometric training regimen to a swimmer’s normal training could decrease his/her overall race time. Investigators discovered that in a 50-m sprint, a swimmer could decrease his/her overall time by approximately 6.5 seconds by adding 2 hours of plyometric training per week (4). Figures 4 and 5 demonstrate 2 different types of plyometric exercises useful for swimmers. Streamline squat jumps (Figure 4) and lunge jump switches (Figure 5) primarily focus on the triple extension used off the block during the start and off the walls during the turns.

The start and turn components of a 50-m freestyle race consumes 49.5% of the event time (4,9). During the swim component, the swimmer focuses on correct body position, catch, pull, and kick. For proper body position, a swimmer must have complete control over his/her body starting within the core. The core is defined as the area between the
sternum and the knees, with a focus on the abdominal region, low back and hips (1)." Unlike land sports (football, running, skating, soccer, etc.) where the athlete’s feet are in contact with the ground, in swimming, the stability from the core muscles provides the necessary buoyancy and streamlining. The weaker the core the more energy it takes to swim, resulting in less powerful pulls and kicks (1). Figures 6–12 provide several sport-specific strength exercises to increase the strength and power of the freestyle stroke. Swimmer push-ups (Figure 6) focus on the triceps, serratus anterior, pectorals, and anterior deltoids that are needed during the catch and finish of the stroke. Internal/external rotation (Figures 7, 8) and catch (Figure 9) exercises focus on increasing stability and strengthening the surrounding muscles of the glenohumeral joints. The plank (Figure 10) and streamline superman (Figure 11) activate the abdominal and paraspinal muscles, respectively. The freestyle catch and roll (Figure 12) exercise involves the highest level of coordination and is the closest simulation to the actual freestyle stroke. Streamline squats (Figure 13), lunge with a twist (Figure 14), and flutter kick (Figure 15) require lifting through the core and complete body control. Sport-specific strength training with these exercises can increase core strength and stability that will enhance the swimmer’s body control and technique (2). By adding these exercises to a weekly training
regimen as indicated in the Table, you will decrease your risk for shoulder injuries and increase your strength, power, and swimming technique.

SUMMARY

Sport-specific strength training has been shown to help increase strength, power, and body control if implemented correctly. A swimmer needs to train in all 4 areas of strength, power, stability, and technique because half of a 50-m race consists of power and strength, whereas the other half consists of stability and technique. A proper strength training regimen is also crucial because an average swimmer performs approximately 2,500 shoulder rotations per workout. Without proper stability and strength of the glenohumeral joint and corresponding muscles, shoulder injuries can occur. By performing the demonstrated exercises 2–3 times a week, each swimmer could increase his/her strength and stability throughout his/her body that could result in proper technique, less injuries, and faster swim times.

EXERCISES

STREAMLINE SQUAT JUMPS

- Movement (Figure 4)
  - Start in the squat position with arms raised over head, hands on top of each other, and biceps squeezing ears
  - Using core and triple extension: hip, knee, and ankle drive off of the ground from toes into the air as high as can go
  - Land back on feet shoulder width apart in squat position
  - Repeat.
**LUNGE JUMP SWITCH**
- **Movement (Figure 5)**
  - Start in a lunge position with one leg in front of body, whereas the other one steps backward and knee dropped toward the ground.
  - Having lowered knee directly below your hip
  - Use triple extension: hip, knees, and ankles to drive off of the ground into the air switching positions of legs
  - Land back in a lunge position with legs in the opposite positions
  - Repeat.

**SWIMMER PUSH-UPS**
- **Muscles engaged (Figure 6)**
  - Deltoids
  - Pectorals
  - Latissimus dorsi
  - Triceps brachii
  - Abdominals
  - Serratus anterior
  - Anterior deltoid
- **Movement**
  - Starting in plank position
  - Lower body toward the ground keeping elbows next to body
  - Raise body back up into plank position
  - Repeat.

**INTERNAL ROTATION (RUBBER TUBING)**
- **Muscles engaged (Figure 7)**
  - Deltoids
  - Teres major
  - Latissimus dorsi
  - Pectoralis major
  - Subscapularis
- **Movement**
  - Stand feet shoulder width apart with back facing the rubber tubing
  - Hold the rubber tubing in hand that is vertical to your elbow at shoulder height
  - Keeping the elbow still and core tight pull the rubber tubing forward, so hand becomes horizontal to the elbow.

**EXTERNAL ROTATION (RUBBER TUBING)**
- **Muscles engaged (Figure 8)**
  - Deltoids
  - Infraspinatus
  - Teres minor
- **Movement**
  - Stand feet shoulder width apart facing the rubber tubing
  - Holding the rubber tubing in one hand which is horizontal with elbows at shoulder height
  - Keeping the elbow still and core tight pull the rubber tubing backward so the hand becomes vertical to elbow.

**CATCH (RUBBER TUBING)**
- **Muscles engaged (Figure 9)**
  - Deltoids
  - Triceps brachii
  - Brachioradialis
- **Movement**
  - Stand feet shoulder width apart with right side facing a pole with rubber tubing
  - Extend right arm out and grab the rubber tubing
  - Keeping core tight and body still drop right wrist raising right elbow, keeping wrist outside the elbow, and relax
  - Repeat.

**PLANK**
- **Muscles engaged (Figure 10)**
  - Erector spinae
  - Rectus abdominis
  - Transverse abdominis
- **Movement**
  - Lay prone (facedown) on the ground
  - Place hands shoulder width apart below chest and drive toes into the ground
  - Raise body up and engage all muscles to hold body flat
  - Hold for 30 seconds to 2 minutes and relax
  - Repeat.

**STREAMLINE SUPERMAN**
- **Muscles engaged (Figure 11)**
  - Deltoids
  - Trapezius
  - Abdominals
  - Gluteus maximus
  - Hip flexors
  - Quadriceps
  - Hamstrings
  - Serratus anterior
  - Erector spine
  - Multifidus
  - Supraspinatus
  - Subscapularis
Infraspinatus

Teres minor

Movement

Lie prone (facedown) on a mat with arms stretched out beyond head

Engage entire body; raising legs off the ground and placing arms in streamline position

Hold for 10–15 seconds and relax

Repeat.

**FREESTYLE CATCH AND ROLL**

- Muscles engaged (Figure 12)
  - Deltoid
  - Triceps brachii
  - Trapezius
  - Latissimus dorsi
  - Abdominals
  - Gluteus maximus
  - Quadriceps
  - Gastrocnemius
  - Erector spine
  - Multifidus
  - Supraspinatus
  - Subscapularis
  - Infraspinatus
  - Teres minor

- Movement
  - Begin laying on side with the bottom arm extended out past the body beyond the head and the top arm extended alongside the body
  - Raise the top arm’s elbow up toward the sky and extending the top arm over and past the head
STREAMLINE SQUATS

- Muscles engaged (Figure 13)
  - Deltoids
  - Trapezius
  - Quadriceps
  - Hamstrings
  - Gastrocnemius
  - Gluteus maximus

- Movement
  - Stand with feet shoulder width apart
  - Extend arms out at shoulder level
  - Step forward with right foot and drop left knee (not touching the ground)
  - From core twist upper body so left arm is extended above right leg and right arm is extended over left foot
  - Hold that position for 2–3 seconds
  - Slowly move arms back to sides straightening the body
  - Step right foot back so standing shoulder width apart
  - Repeat alternating sides.

LUNGES WITH TWIST

- Muscles engaged (Figure 14)
  - Deltoids
  - Abdominal muscles
  - Quadriceps

- Movement
  - Lay supine (face up) on a mat

- Raising the bottom arm’s elbow and rolling to the other side
- Repeat.

- Hamstrings
- Gastrocnemius
- Gluteus maximus
- Gluteus medius

- Raising legs approximately 6 in from the ground
- Straighten legs, point toes, and raise and lower legs repeatedly.

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