

Drag Force

Taking the guess work out of drag equipment

By: Monique Acton & Laurie Denomme

Condensed Version Originally Published – AKWA Magazine October/November 2006

Take the guess work out of using drag equipment by incorporating the ideas in this article for proficient movement execution. There are various types of equipment that can be used in the aquatic environment to achieve gains in cardiorespiratory and muscular endurance. This article will discuss appropriate intensity variation of movements targeting muscular endurance through use of the drag forces of the water. Further application and progression will be discussed for those new to water exercise or reconditioning an injury using drag equipment.

Drag is the resistance you feel during movement in the water. The amount of drag is determined by the surface area and shape of the object combined with the viscosity of the water and speed at which it is moving (AEA, 2005). Integrating various types of drag equipment will alter the amount of **drag force** based on their shape and surface area.

Knowing how to use your equipment is paramount to moving joints through a safe range of motion and safely integrating someone into a water exercise program. Drag equipment is popular for its ability to target muscle pairs in a single movement as it simply magnifies the drag forces of the water. The use of drag equipment, like water itself, elicits concentric contractions in any direction of movement targeting a muscle pair in a single exercise/set.

The drag equipment explored in this article includes the following:

Lower Extremity (Illustration 1)	Upper Extremity (Illustration 2)
Speedo Hydro Kick Boxers®	Gloves
Hydro-Tone Mini-Fins©	Aquaflex Paddles®
Theraband Aquafins™	Speedo Hydro Boxers®

Illustration 1 – Lower Extremity Equipment



Illustration 2 – Upper Extremity Equipment



Choosing the right equipment to provide an appropriate level of intensity can sometimes be a challenge. Due to differences in surface area and shape of equipment it may be necessary to adjust equipment placement, base of support, and range of motion to move safely and effectively. Each type of drag equipment will offer various amounts of resistance based on the equipment structure itself as well as the individual using it. Each person will experience a different amount of intensity based on how far the equipment is placed from the moving joint, how much force is applied and the speed at which they move. For example, an individual who is tall having longer limbs will experience a greater drag effect than a shorter individual if they are asked to perform the exact same movement at the same speed.

Exercises for the Lower Extremity

The Speedo Hydro Kick Boxers® are designed to be worn during an entire cardio class or during the resistance portion of a workout; the Hydro-Tone Mini-Fins© and Theraband Aquafins™ are for use during the muscular endurance segment of a workout. Therefore you will find by design, the Speedo Hydro Kick Boxers® offer the least amount of resistance. To simultaneously train the core muscles move from waist to chest depth water for any of the lower extremity exercises.

Hip Flexion & Extension

Follow the guidelines in the chart below to put on the equipment and begin each movement in the most effective stance position.

Table 1. Hip Flexion & Extension	Speedo Hydro Kick Boxers®	Theraband Aquafins™	Hydro-Tone Mini-Fins©
Effective Equipment Placement	Attach just above the ankle with the opening to the inside or the back of the ankle.	Attach just above the ankle with the logo right side up facing forward. To make the fit snug dorsi flex at the ankle before tightening and closing the strap at the back.	Attach just above the ankle . To make the fit snug dorsi flex at the ankle before tightening and closing the strap at the back. The Min-Fins may need to be placed slightly higher than the Aquafins to stay secure.
Stance	Center Stance <i>Feet shoulder width apart.</i>	Wide Center Stance <i>Feet slightly wider than shoulder width apart.</i>	Wide Center Stance

Posture Cues & Intensity Variation

- Slightly flex the knee during hip flexion and emphasize hip extension to reduce the load on the hip flexors and focus on strengthening the gluteals and hamstrings. During hip extension cue to brace the abdominal region by activating the transverse abdominis and obliques to lower the risk of hyperextension.

Hip Abduction & Adduction

During hip abduction and adduction, the Theraband Aquafins™ provide slightly more resistance than the other types of equipment that were examined. Therefore, if you have access to the various types of equipment a sensible progression would be no equipment, Speedo Hydro Kick Boxers®, Hydro-Tone Mini-Fins© to Theraband Aquafins™.

Table 2. Hip Abduction & Adduction	Speedo Hydro Kick Boxers®	Theraband Aquafins™	Hydro-Tone Mini-Fins©
Effective Equipment Placement	Attach using the same guidelines outlined in Table 1. Hip flexion & extension.	Attach using the same guidelines outlined in Table 1. Hip flexion & extension. However, place the logo right side up facing away from the midline.	Attach using the same guidelines outlined in Table 1. Hip flexion & extension. However, place the logo right side up facing away from the midline. Option to place the Mini-Fin on the medial side of the leg facing inward for less stress to the knee.
Stance	Center Stance	Center Stance	Center Stance

Posture Cues & Intensity Variation

- Slightly flex the knee of the working leg during hip abduction and adduction for less stress to the knee joint.
- Lead with the side of your foot to avoid external rotation at the hip.
- Squeeze the gluteals during hip abduction to facilitate safe 0-45 degrees range of motion.
- In waist deep water performing a squat into single leg abduction increases the intensity of the movement.

Knee Flexion & Extension

To put on the equipment follow the guidelines outlined in Table 1. During knee flexion and extension a center stance is appropriate for the Speedo Hydro Kick Boxers® but a wide center stance will be necessary to accommodate for the larger surface area of the Theraband Aquafins™ and Hydro-Tone Mini-Fins©. The working leg can be placed in two different start positions to safely perform knee flexion and extension; either with the knee positioned under the hip pointing down to the pool bottom or flexing at the hip and suspending the leg.

Posture Cues & Intensity Variation

- When using the Hydro-Tone Mini-Fins © or Theraband Aquafins ™ for suspended knee flexion and extension, the hip should be flexed and externally rotated (avoid excessive hip rotation for hip replacement).

Exercises for the Upper Extremity

Each exercise can be progressed by simultaneously training balance and muscular endurance in tandem by using various stance positions. A lunge stance, allows weight to be distributed from front to back providing a stable base of support. Center stance, having feet shoulder width apart also offers steady support. To intensify the difficulty, narrow the base of support by using either a tandem stance “one foot directly in front of the other” or a one leg stance “supported on one leg.” These more advanced stances will enhance functional abilities and improve balance; skills especially important for those that may be favoring an injured limb or have poor proprioception of the ankle, knee and hip. In addition, upper extremity movements will constantly challenge the trunk and lower extremity as they are called upon to maintain balance and neutral body alignment.

To improve range of motion and enhance muscular endurance of the upper extremity submerge the shoulder joint; performing the exercises in the right water depth is especially important when one is reconditioning a shoulder injury. To submerge the shoulder in a shallow water program, a person can simply widen their base of support while flexing at the hip and knees.

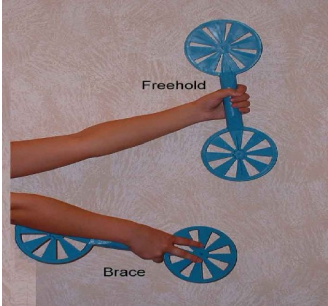
Follow the guidelines in Table 3 to put on the equipment for all of the exercises designed for the shoulder. For all types of equipment individuals should be reminded to set the scapula “roll the shoulders back and down”, engage the muscles of the core and maintain neutral wrist alignment.

When using gloves the cueing will be similar for all shoulder exercises. Prompt participants to:

- Lead with the thumbs up or down (i.e.) breast stroke arms with the thumbs up.
- Lead with the palm OR the back of the hand (i.e.) elbow flexion/extension can be lead with the palm in both directions by using pronation and supination of the forearm.
- Combine leading with the back of the hand and with the palm (i.e.) transverse shoulder abduction/adduction leading with the palm during adduction and with the back of the hand during abduction.

Progressions:

- Hand sliced sideways or closed in a fist – minimal resistance
- Flat palm, leading with the palm or back of the hand – moderate resistance
- Cupped “claw” having the hand open with the fingers cupped – greatest resistance

Table 3. Shoulder Exercises	Speedo Hydro Boxers ®	Gloves	Aquaflex Paddles ®
Effective Equipment Placement	<p>Slide hand into opening using a relaxed grip. The arms need to be away from the body slightly to allow for the Speedo Hydro Boxers ® to move without coming in contact with the torso.</p> <p>Manufacturer disclaimer “One size fits all. Multi-directional resistance with ergonomic design allows you to hold the Hydro Boxer at the end OR put you hand inside so that you need not grip the equipment. Does not aggravate shoulder or carpal tunnel problems”. It forces the wrist to stay in neutral alignment in all directions of movement.</p>	It is easiest to put on gloves when the hands are dry.	<p>Brace – place one end of the fan against the forearm with the hand gripping the center bar nearest the opposing fan. Place the thumb on one side of the bar with one or more fingers extending over the fan to allow for greater control of paddle movement.</p> <p>Freehold – place your fingers and thumb together in a slightly cupped position; grip the paddle by closing your hand around the center bar. The arms should be held away from the torso to allow the paddle to move freely.</p> 

Shoulder Flexion & Extension

Posture Cues & Intensity Variation

- Increase the intensity when using the Aquaflex Paddles ® by cueing to slice, turn the paddle $\frac{3}{4}$ of the way against the water's resistance, to the paddle turned fully against the water for greatest resistance. Intensity can also be adjusted by keeping the slots open for easiest resistance or closing the slots for greater resistance.
- Focus can be placed on one muscle group by moving against the water using the greatest frontal surface area the gloves or Aquaflex Paddles ® provide; and then slicing in the return motion.
- Perform the exercise with just a single arm while resting the opposite arm on the hip to increase the workload of core muscles.

Transverse Shoulder Abduction & Adduction

Posture Cues & Intensity Variation

- When using the Speedo Hydro Boxers ® no additional cueing is needed.
- When using Aquaflex Paddles ® the instructor should provide the option of using a brace or freehold (see Figure 3 and Illustration 3). The **brace** allows the individual to have good control over their equipment and provides more freedom of movement. When using the **freehold** cue the individual to place their arms lower in the water to submerge the entire paddle.
- Options for movement-return motion: Claw- back of the hand, supination-pronation, slice-back of hand, or palm-slice.

Shoulder Abduction & Adduction

Posture Cues & Intensity Variation

- When using the Speedo Hydro Boxers ® be careful not to hit the sides of the body with the equipment.
- Cue to use an easy grip when using Aquaflex Paddles ®; the freehold requires additional engagement of the core muscles to maintain balance.
- Movement can be directly out to the side of the body or for increased range of motion adduct the arms behind the body.
- Center or lunge stance will be the easiest stance when using both arms; add movement of the lower extremity such as a jog to apply further challenge to the stabilizers of the core.
- Options for movement-return motion: Claw- back of the hand, supination-pronation, slice-back of hand, or palm-slice.

Elbow Flexion & Extension

Posture Cues & Intensity Variation

- Elbow should be placed directly under the shoulder approximately a fist width away from the torso.
- When using the Speedo Hydro Boxers ® no additional cueing is needed.
- Aquaflex Paddles ® – if using a brace decide if palms are up, down or alternating; for the freehold, cue the arms wider so paddles do not strike the body.
- Perform in the sagittal plane or coming across the body from anatomical position to the opposite shoulder and back to start position “diagonal flexion/extension”.

Individuals looking for transitional programming may be limited to the type of exercise as well as the duration and frequency they can tolerate on land. Water provides a sensible opportunity for those with limitations, to work more frequently and with greater intensity and duration (AEA, 2004). Transitioning an individual into the water as a post-rehab modality, an introduction to exercise or as a cross training activity, requires an understanding of the factors that will be called upon to progressively overload the body.

The benefits of drag can be experienced by both the new and advanced participant. This article reviewed how to effectively use drag equipment during single plane movements for post-rehab or new participants transitioning into an aquatic exercise program. However, movements you can perform using drag are limited only by your imagination!

To experience an in-depth review of this concept and additional multi-plane progressions appropriate for the new and advanced water exerciser join Monique and Laurie in the hands on workshop called ***Drag Force: Practical Aquatic Progressions. Coming in 2007!***
