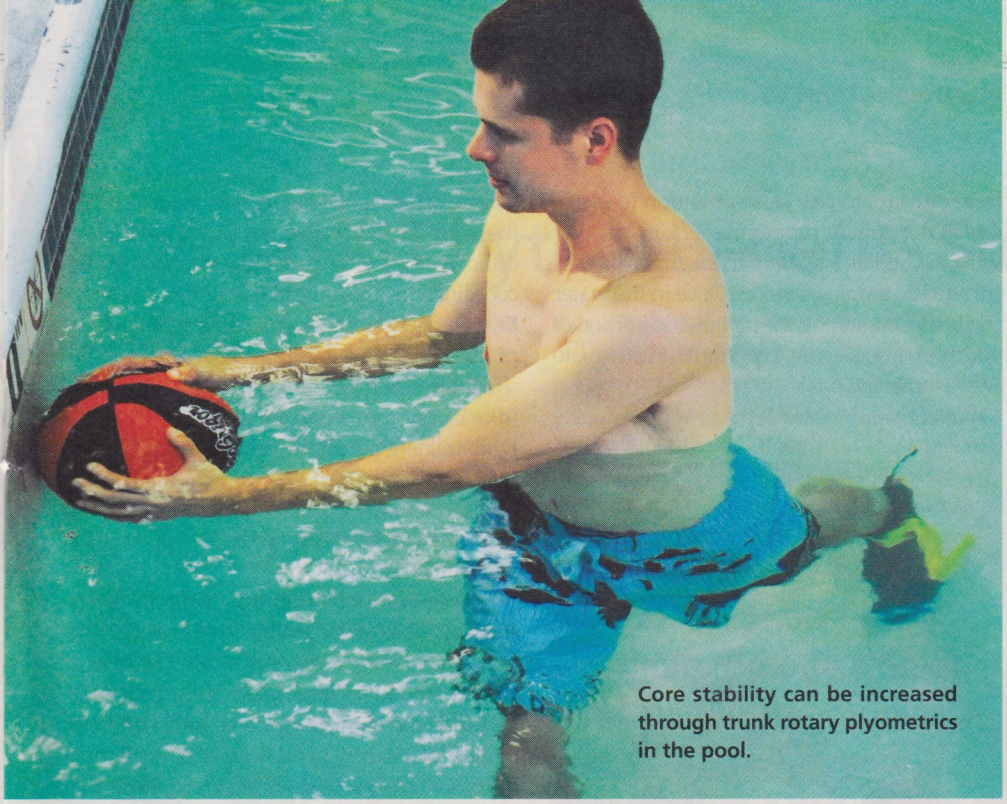

Core stability can be increased through trunk rotary plyometrics in the pool.

COURTESY RICK MCAVOY

Power in the Pool

How athletes can train both hard and smart with aquatic plyometrics

By Rick McAvoy, PT, DPT, CSCS

Plyometric training is both a high-intensity and high-impact form of conditioning. It consists of explosive movements that require muscles to rapidly adapt from eccentric muscle actions to concentric contractions. When a muscle is stretched in an eccentric contraction, it stores elastic energy for a brief period of time.

When the energy stored is followed by a quick concentric contraction, a greater amount of force is produced. Plyometrics has been used for years to improve an athlete's overall explosive power. Numerous research studies have demonstrated improvements in vertical jump, acceleration, and proprioception and leg strength by incorporating land-based plyometric training.

There are, however, certain factors to consider when developing a land-based plyometric program such as age, experience and athletic maturity. Athletes require an adequate level of strength to tolerate the large amounts of stress and force experienced during training. The risks associated with land-based plyometric training are acute muscle soreness, muscle damage and acute musculoskeletal injuries. By incorporating aquatic plyometric training with your clients/athletes, most of these risks are significantly reduced.

Aquatic plyometric training is by no means a new concept. Injured athletes for years have rehabilitated by performing aquatic plyometric training. Now, however, there are numerous research studies that document plyometrics performed in the water appear to have similar if not improved benefits to performance when compared to land-based training.

Water Properties

The water's properties allow for a safer and less stressful environment compared to land-based plyometric training. Water is both a supportive and resistive medium in which to train.

The buoyant forces of the water reduce the amounts of force and joint compression during the landing phase of plyometric training. However, they do not entirely reduce the amount of force that is produced to control the eccentric phase of the movement. The buoyant forces merely reduce the weight and stretch reflex before facilitating an increased resistive concentric contraction as the athlete attempts to jump out of the water and break surface tension. This shortened amortization phase and reduced load could produce improvements in muscle power outputs at higher velocities.

Training in the water also reduces the speed of the movement and allows the athlete to help improve his motor patterning as he becomes more proficient in plyometric training. In addition, this reduced speed of movement allows the therapist/trainer a better period of time to note faulty movement patterns.

Three-Dimensional Resistance

Water provides three-dimensional resistance unlike land, which only provides resistance in one direction. This tends to allow for a more holistic and functional approach to training, providing an important training stimulus for the athlete. The water's hydrostatic pressure can aid in providing the athlete a "second pair of hands" to improve posture and technique in an immersed environment.

Ground-reaction forces are significantly reduced while performing plyometrics in the water. A recent study has shown a reduction of 33 to 54 percent compared to land-based training. Because of this decreased load and eccentric forces applied, the athlete is at much less risk to develop delayed-onset muscle soreness.

Program Recommendations

With any rehabilitation or sports-performance training, the focus must be on the functional or sports-specific needs to meet the demands of the desired activity.

Attire: It is recommended that athletes wear a bathing suit that is somewhat conforming to the body to minimize the amount of drag and facilitate increased speed of movement. T-shirts are discouraged as well because of the increased drag forces created. If pool temperature is an issue, have your athlete wear a form-fitting rash guard to increase warmth. To prevent slippage and ensure proper technique, a good pair of non-slip aquatic shoes is a necessity. These will also assist in the agility and speed work that you will be working on in the water.

Equipment: I have found that rubber roadside cones, which can be purchased at Home Depot or Lowe's, work very well. They not only sink and stay on the pool bottom, but you can also take a 1-inch piece of PVC pipe with 90-degree elbows and make a hurdle to jump over. The cones are very effective because they come in varying heights and are durable. Aquatic boxes are submersible-designed boxes with non-slip surfaces that are used as well for depth-type jumps. These work very well and come in a few different heights.

Instruction: It is very important during the initial phase of aquatic plyometric training that correct and specific instructions are given. It is

recommended that the athlete receives proper instruction on land regarding the type of drill before entering the pool. In my experience, most athletes jump and land improperly in the early phases of aquatic conditioning, almost always leaving/landing on their dominant foot without even knowing it. It is very difficult for the trainer/therapist, especially if working with a larger group, to pay close attention to everyone in the pool. A proper on-deck instruction with the athlete will help to ensure a successful aquatic training session. Once in the water but before beginning the plyometric portion of your training, be sure to perform an adequate warm-up in the pool.

Water Depth: Water depth at approximately waist level or slightly higher is recommended. If the water is too deep then the athlete will have a difficult time with alignment, stabilization and coordination. This may also lengthen the amortization phase of the plyometric activity and not produce the desired training effect.

Mode: When we think of plyometrics either in or out of the water, we generally think of jump training pertaining primarily to the lower body. However, depending on the sport and specific demands, plyometric training can be incorporated for the lower body, upper body and trunk.

Lower-Body Plyometrics: Primarily jump training. This is the ability for the athlete to produce increased lower-extremity force in a shorter amount of time, hence increasing vertical jump and explosive power. Jump training consists of a variety of drills for standing jumps, hops, bounds, box drills, depth jumps etc. In the pool, the trainer/therapist can get very creative. The athlete can start with both feet on the side of the pool and blast off in a horizontal position as a warm-up and then begin to increase vertical challenges in forward/back/lateral positions. Athletes in the water tend to take a greater risk when jumping over a higher obstacle because if they fall, they will just land in the water and not injure themselves.

Upper-Body Plyometrics: Plyometric drills for upper-body power can assist any athlete who requires an increased demand on the core and shoulder musculature. In the water by incorporating medicine balls or basketballs, the athlete can use the wall of the pool or the steps to perform explosive upper-body plyometrics such as wall pushes or step explosive pushups. The added benefit from the water is the athlete has to overcome buoyancy to keep the ball under the water, which assists in increasing core musculature recruitment.

Trunk Plyometrics: Plyometric drills can be performed for the trunk as well. This is especially important in throwing and racquet sports. Although not truly plyometric in theory, the trunk can be trained incorporating explosiveness in a rotary fashion. In the water as previously mentioned by incorporating balls that float, the athlete can increase core stability as well when performing trunk rotary plyometrics.

Conclusion

Aquatic plyometric training offers therapists and trainers an alternative to traditional land-based

power continued on page 36

[PILATES]

Pilates continued from page 28

the framework of rehab, it's a great way to look at somebody's movement and have that person exercise."

Dr. Rubenstein opted for a Pilates certification geared heavily geared toward rehab, a move she believes has allowed her to effectively combine manual therapy with Pilates. "If Joseph Pilates were here today, he would have evolved his own system," stated Dr. Rubenstein. "He would not be doing it the way he did it back then. I would recommend going to one of the rehab-based Pilates training courses, because it is geared more toward physical therapy, and you won't have to go through things you already know, such as anatomy." ■

Greg Thompson is a freelance writer in Fort Collins, CO.

[AQUATICS]

power continued from page 32

training. Not only beneficial for an injured athlete, it can also be incorporated into any phase of an athlete's training.

Although aquatics should not be the only way to train plyometrics, it's a nice addition to your traditional training regimen. Just like any other training modality, aquatic training should be incorporated into a well-designed, comprehensive physical conditioning program. ■

References

1. Arazi, H., & Asadi, A. (2011). The effect of aquatic and land plyometric training on strength, sprint, and balance in young basketball players. *Journal of Human Sport and Exercise*, 6(1), 101-111.
2. Chu, D. (1998). *Jumping into Plyometrics (2nd ed.)*. Champaign, IL: Human Kinetics.
3. Colado, J., Garcia-Masso, X., Gonzalez, L., Triplett, N., Mayo, C., & Merce, J. (2010). Two-leg squat jumps in water: An effective alternative to dry land jumps. *International Journal of Sports Medicine*, (31), 118-122.
4. Colado, J., Tella, V., & Llop, F. (2006). Response to resistance exercise performed in water versus on land. *Rev Port Cien Desp, 6(Supplement 2)*, 361-362.
5. Donoghue, O., Shimojo, H., & Takagi, H. (2011). Impact forces of plyometric exercises performed on land and in water. *Sports Health*, 3(3), 303-309.
6. Martel, G., Harmer, M., Logan, J., & Parker, C. (2005). Aquatic plyometric training increases vertical jump in female volleyball players. *Medicine & Science in Sports & Exercise*, 37(10), 1814-1819.
7. Miller, M., Cheatham, C., Porte, A., Ricard, M., Hennigar, D., & Berry, D. (2007). Chest- and waist-deep aquatic plyometric training and average force, power and vertical-jump performance. *International Journal of Aquatic Research and Education*, 1(1), 145-155.
8. Miller, M., Herniman, J., Ricard, M., Cheatham, C., & Michael, T. (2006). The effects of a six-week plyometric training program on agility. *Journal of Sports Science and Medicine*, (5), 459-465.

Rick McAvoy is owner of McAvoy Aquatic & Sports Therapy. He works at aquatic training centers in Portsmouth, NH, and Kennebunk, ME, and is also aquatic program coordinator at Rehab 3 at Marsh Brook Center for Aquatics in New Hampshire. He can be contacted at www.Masth2o.com

[PAIN MANAGEMENT]

pain continued from page 30

Studies of osteoarthritis show a lack of correlation between the degree of degenerative changes and the magnitude of the subject's pain. In one study, hypertonic saline was injected into the tibialis anterior muscle of subjects presenting with lower limb osteoarthritis. Increased pain intensity and duration was reported in OA patients versus controls, suggesting a central component to the pain.[2] In the case of spinal nerve compression, nociceptive action potentials spread toward both the CNS and to the periphery, creating neurogenic inflammation and pain. This antidromic activity is implicated in interstitial cystitis and the swelling associated with tendonitis.[3]

Inactivating Trigger Points

Treatment is focused on inactivation of the trigger points. Numerous studies have established the efficacy of manual techniques on pain relief, restoration of pre-injury muscle length and tension, and return to function. Techniques include trigger point compression, muscle energy technique, strain-counterstrain, myofascial release and deep dry needling. While superficial dry needling will not inactivate a trigger point, it is believed to cause central release of oxytocin and stimulate regions of the brain involved in feelings of well-being.

Breathing retraining is indicated to downtrain the autonomic nervous system. Joint mobilization techniques address the close association between muscle and articular dysfunction and may produce pre-synaptic inhibition of segmental pain pathways and a decrease in trigger point sensitivity. An increased focus in the current literature is on the influence of fascia in musculoskeletal pathology. Because of connections within the fascial system, pathology in one body part may adversely affect force transmission to another, creating undue torque and altered joint and muscle function and setting the system up for trigger point formation.

Clinicians involved in the diagnosis and treatment of musculoskeletal syndromes should consider further training in the assessment and treatment of trigger points and familiarize themselves with the many relevant, informative research studies. ■

References are available online at www.advanceweb.com/PT.

Louise Kelley practices at Bethesda Physiocare in Bethesda, MD.