

Aquatic Therapy in Spinal Cord Injury



Rachel Mertins, DPT, ATRIC, works on static standing with Elizabeth Dunn, a 25-year-old with a cervical spinal cord injury. Aquatic specialist Erik Schlegel provides a second set of skilled hands to ensure proper alignment and weight-bearing. (Photo Location: PruittHealth – Savannah)

Hydrotherapy, more commonly referred to as aquatic therapy, is one of the oldest therapeutic modalities used in the treatment and management of those with physical dysfunction, like spinal cord injury.^{1,2}

Numerous research articles have shown support for its rehabilitation and healing potential in the treatment and management of populations affected by acute and chronic dysfunction. Aquatic therapy is an integral part of Kennedy Krieger Institute's (KKI) International Center for Spinal Cord Injury (ICSCI) in Baltimore, and it has aided in the attainment of functional goals as well as neurologic recovery.

The incidence of spinal cord injury is approximately 40 cases per 1 million in the United States, averaging to roughly 12,000 new cases each year. With the functional limitations and secondary complications following an injury to the spinal cord, the aquatic environment allows opportunities for movement not supported independently on land. Literature about aquatic therapy—specifically with spinal cord injury—is limited, yet the known benefits are significant and promising. As therapists, we do know that the hydrodynamic and thermal properties of water help create a safe, therapeutic environment.

Therapeutic Characteristics of the Aquatic Setting

Buoyancy. Buoyancy provides opposition to gravity's downward thrust. It also allows individuals to move more freely in the water, ease transfers, alter weight-bearing, and decrease compensatory movements. Individuals affected by spinal cord injuries present with a challenging array of concerns, including increased or decreased muscle tone, increased or decreased spasticity, wounds, impaired or absent sensation, impaired or absent movement, and pain. Buoyancy can decrease joint stress and allow for freedom of movement.

Hydrostatic Pressure. In therapy, the natural pressure gradient can be used to assist in venous and lymphatic blood flow. The benefits of hydrostatic pressure properties allow the cardiac and renal systems to work more efficiently than on land. This property will assist with edema management, increasing urine output, blood flow, and influence respiratory resistance. The pressure will also create an environment of sensory stimulation overload, which will further assist in desensitization. This pressure gradient can be adjusted based on the depth of water in which the

patient is emerged. The deeper an individual is immersed, the greater the pressure.

Viscosity. The resistance provided by water itself can stimulate an increase in sensory stimulation by stimulating those sensory receptors of the skin. The resistance provided by water also provides an environment of security and impact protection in slowing down movements, which includes falls. And, unlike on land, water provides natural resistance and can be graded based on movement speed and water depth.

Thermal Properties. Water is an environment that has been identified as the greatest conductor of heat. It is important for a therapist to choose activities that match and work best with the water's temperature. Additionally, the relaxation phenomena of the warmer water and relaxation of muscle may cause a decrease in pain symptoms and spasticity.

Equipped and Staffed to be Effective

The ICSCI at the Kennedy Krieger Institute routinely uses the aquatic environment in conjunction with land therapies as part of its Activity-Based Restorative Therapy program. ABRT utilizes activity as the mechanism for neurological recovery through patterned and non-patterned activity and sensory feedback.³ The aquatic environment supports this high-repetition training in a safe and effective manner to assist with functional goal attainment and neurological recovery.

The aquatic facility at Kennedy Krieger Institute comprises two state-of-the-art therapy pools. Among the useful features of these pools is the ability of the pool floors to raise and lower from 0 to 6 feet, and the presence of a treadmill in one of the pools. With the ability of the pool floor to be equal to the deck floor, easy entry and exit from the pool is available for those with decreased functional mobility. Patients are able to access the pool safely and efficiently in a variety of ways, tailoring to their functional capacity; these include direct ambulation onto the pool floor, utilizing a water wheelchair to roll onto the pool floor, or by ceiling lift to slowly lower into the water at a lowered depth. The pools are kept at 92°F and 94°F to utilize the thermal properties of water. The treadmill in the smaller pool allows for a speed of .1 mph to 8 mph for gait training, and is outfitted with parallel bars that are removable. Both pools are equipped with adjustable jets to for resistance as well as underwater cameras to view activity and record therapy sessions. These adjustable features of the pools allow for greater personalization of therapy.

Our aquatic therapists are a team composed of occupational and physical therapists, and adapted aquatic specialists. All therapists undergo training and numerous competencies before they are able to treat independently in the aquatic environment. Most of our aquatic therapists have participated in extensive aquatic certification programs, including the Certificate in Aquatic Physical Therapy Clinical Competence through the American Physical Therapy Association and the Aquatic Therapy & Rehab Institute's Aquatic Therapeutic Exercise Certification.

Selecting Patients for a Hydrotherapy Program

When working with the SCI population, at some point it must be determined which patients are good candidates for aquatic therapy. The answer is simple: anyone who has functional goals that can be addressed successfully in the water and complement interventions on land. When a patient begins treatment in our acute or outpatient programs, that person is evaluated on land to identify goals and current functional abilities. Subsequently, the therapist determines whether the patient can further work on goal attainment using the properties of water. If a patient is recommended to partake in aquatic therapy, a medical referral is generated by that person's physician and scheduling occurs. Communication between both the land and the aquatic therapists occurs to generate a patient-specific treatment plan. Aquatic therapy should always serve as an adjunct to land-based therapies with the ultimate goal of transitioning any acquired skill gained in the pool to land. Continuous evaluation of progress toward goal attainment occurs in both environments.

Typical patients appropriate for aquatic therapy could include a person affected by:

-significant tone that impacts daily activities;

- pain that limits sitting tolerance or functional activities;
- decreased active range of motion;
- decreased functional mobility (rolling, transfers, ambulation); or
- high fall or fracture risk.

Special Considerations

Aquatic therapy is beneficial for both acute and chronic injuries throughout the life span. Those with acute injuries typically need more frequent monitoring of vital signs due to their higher frequency of autonomic dysreflexia and orthostatic hypotension. Level of injury will also impact the clinical decision-making process for aquatic therapy, as those with higher-level injuries will require more dependent mechanisms to enter and exit the pool, or may have additional precautions due to the presence of diaphragmatic pacers or tracheostomy tubes. These patients may also require the use of additional personnel in the pool to ensure safety and to properly engage in tailored interventions.

Facilities that offer aquatic therapy may find that pool lifts not only assist entry/exit but can also help reduce anxiety some patients may feel about entering the water without an assistive device. In such cases, a facility may choose to install an ADA-compliant chair lift or sling lift. These are available in several configurations that include water-powered models and bariatric units.

The aquatic environment provides a unique, less restricted environment for someone with little movement to allow for treatment sessions that will allow for easy access for scapular mobilizations, transitioning a patient to prone with a snorkel, and promoting gentle active and passive range-of-motion. Lower-level injuries or those that are incomplete may require additional personnel in the pool to assist with gait training.

Program Plan

Patients are typically seen in aquatic therapy twice per week in addition to their land therapies. Aquatic therapy sessions typically last 1 hour but can be shorter for patients who may have decreased tolerance to heat, such as those affected by multiple sclerosis. Besides decision-making about goals being addressed in the pool, the selection of appropriate equipment is just as important. Patients may require more or fewer floatation devices, weights to help counterbalance buoyancy, kickboards, water dumbbells, grasping toys, pool noodles, watercolor paint, snorkels, etc.

Aquatic therapy is understudied currently, but through subjective and objective assessment within our clinic, it has shown to be applicable among the general SCI population. It has proven to be an appropriate rehabilitation tool for those affected by a variety of functional limitations, levels of injury, degrees of completeness, and secondary medical conditions. It is often a motivating environment in which to complete therapeutic intervention, and demonstrates larger degrees of active movement and decreased tonal influence than what is attainable on land. A key factor in obtaining the functional benefits for our patients is having skilled aquatic therapists who design custom treatment programs and execute them with their patients over an extended period of time. Interventions are most beneficial when taught and engaged in during a therapy bout of care but also as part of a home- or community-based aquatic home therapy program.

Summer is upon us, and that means warm weather, bathing suits, and water. This also means more of a possibility for rehabilitation in a pool for people who may not typically have access to indoor pools. Fortunately, access to indoor pools allows many people to participate in swimming and warm water exercise year-round. Developing research is sharing the findings about how the aquatic setting offers a unique environment to enhance rehabilitation for a variety of individuals affected by neurological and/or orthopedic conditions.

Case study: Joe Kelly

Ironically, while one of the ICSCI therapists was at her local community pool, she met a man who would soon become a future patient. She noticed his awkward gait pattern, which led to a discussion between the two during which the therapist shared the exciting advances in SCI rehabilitation. After Joe completed further research and learned more about KKI and the ICSCI program, he scheduled a medical appointment.

This 31-year-old man had sustained an SCI from a surfing/diving accident in 1998, during which he briefly lost consciousness. He was diagnosed with a cervical-level injury SCI and underwent multiple fusions and a laminectomy. Over the course of 2 years, he received OT and PT inpatient and outpatient services and regained the ability to ambulate with bilateral forearm crutches with increased lateral sway coming from weakness in his core, pelvis, and hip muscles. He was mostly modified independent with all ADLs and had returned part-time to work restoring cars. He was limited, however, with his gait and fine motor coordination. He also presented with bilateral weak shoulder girdles and triceps strength.

He hadn't realized that there were new developments occurring in SCI rehabilitation, and in the 5 years after Joe discovered aquatic therapy he participated in both land-based and aquatic therapy. He received aquatic therapy to supplement the progress he was making on land. He also was able to take advantage of a place where he could focus on gait in a safe environment and utilize the properties of water to assist with pain management, muscle tightness, and strengthening. He currently only requires use of walking sticks for uneven terrain and some unknown community areas for increased stability, and to prevent loss of balance. Joe has increased his triceps strength and core strength to maintain quadruped positions and complete reaching tasks which are necessary for his work.

In the last 2 years, Joe transitioned to ICSCI's Individual Aquatic Program and continues to carry out recommended exercises in the pool setting. He participates weekly in the IAP program one to two times a week when he is not actively in therapy. He is also able to carry out the exercises in his community pool.

Joe is a great example of someone who has been able to transition goals to and from the water environment. Although Joe's injury occurred in a water setting, he has not deterred from continuing to incorporate water into his recovery. We have had several patients over the years whose injuries were sustained in a water setting, yet have found returning to the water setting both physically and mentally therapeutic. RM

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