Aquatic Therapy

Clinical Care Program
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What is Aquatic Therapy?

Aquatic Therapy is the practice of physical therapy or occupational therapy by trained and licensed physical therapist/physical therapist assistant or occupational therapist/occupational therapy assistant within the environment of a water-filled pool. Aquatic therapy utilizes hydrodynamic principles of buoyancy, hydrostatic pressure, resistance and temperature are used to facilitate movement, strengthening and functional recovery. The buoyancy, support and accommodating resistance of water enhance exercise and create a safe environment for progressive rehabilitation. The temperature of water (warm or cold) prompts muscle relaxation, facilitates stretching and generally reduces the sensation of pain. Aquatic therapy entails a purposeful progression of skills focusing on psychosocial, cognitive, leisure and motor performance utilizing the properties of water to enhance the benefits of the experience.

The most important ingredient for a successful recovery from any musculoskeletal condition is rehabilitation, which often requires strenuous and painful exercise regimens in order for the patient to regain strength and motion in the affected part. Aquatic therapy is an excellent method to use when normal gravity conditions might make the rehabilitation process difficult, painful, and even dangerous. Aquatic therapy is a part of a comprehensive approach to gaining safe and functional independence and is used in conjunction with traditional therapeutic approaches.

Hydrodynamic Principles

Buoyancy

An important benefit of aquatic therapy is the buoyancy effect provided by the water. Buoyancy can be defined as the upward force that is in the opposite direction of gravity. There are numerous therapeutic benefits of buoyancy and in fact, buoyancy can even provide some benefits to the patient before the patient begins moving in the water. For example, buoyancy decreases weight bearing which decreases joint compression forces and stress on the connective tissues. These decreases can result in decreased pain with standing activities as well as a quicker return to closed chain lower extremity activities and/or gait normalization. The more immersed a patient is in the water, the more of their body weight is offloaded.

The following table indicates the percent of body weight offloaded based on level of the body submersed in water:

<table>
<thead>
<tr>
<th>Level</th>
<th>Percent Offloaded</th>
</tr>
</thead>
<tbody>
<tr>
<td>C7</td>
<td>90%</td>
</tr>
<tr>
<td>Nipple</td>
<td>75%</td>
</tr>
<tr>
<td>Mid-pelvis</td>
<td>50%</td>
</tr>
<tr>
<td>Mid-thigh</td>
<td>35%</td>
</tr>
<tr>
<td>Mid-calf</td>
<td>15%</td>
</tr>
</tbody>
</table>

In addition to decreased weight bearing, buoyancy increases opportunities for challenging the patient’s postural alignment while decreasing their speed of balancer loss. Buoyancy can also be useful for ROM and stretching. Furthermore, buoyancy may improve the ease of handling for the therapist and can increase the ease of raising the extremities within the patient’s visual field. Finally, buoyancy provides opportunities for assisted, supported, and/or resisted movement when working on strengthening. Range of motion completed at an average speed in water is approximately 12 to 15 times the resistance, as compared to movements performed at the same speed on land. Water is estimated to be about 800 times denser than air, requiring more muscular effort and strength.
**Buoyancy Resisted Exercise** is any motion moving away from the surface of water. Buoyancy-resisted motions would be shoulder adduction, or hip adduction while standing in shoulder-deep water. Position changes will alter this concept, for example, if you were wearing a snorkel to breathe while floating in prone position, hip and shoulder flexion would be buoyancy-resisted motions.

**Buoyancy Assisted Exercise** is any motion toward the surface of the water. This facilitates performance of active shoulder flexion and abduction motions for a person with CVA or shoulder rotator cuff repair in shoulder deep water. Buoyancy promotes early controlled motion, with less compensatory movements. In the same respect, it would facilitate hip flexion and abduction, as this is also a buoyancy-assisted motion. It is easier to improve gait and deviated gait patterns in the water. A patient with PWB status could ambulate in 3 to 4 feet of water with a normal gait pattern, without the use of a walker or crutches for support. Similarly, a patient experiencing pain following a pelvic fracture experiences decreased pain with decreased gravitational force, facilitating ambulation and all other lower extremity strengthening exercises. For anyone with balance problems, the buoyancy supports the extremities and spine in an upright position, decreasing the fear of falling. Parkinson’s disease patients can improve their stride length and upright righting reactions during aquatic therapy.

**Buoyancy Supported Exercise** is any exercise performed while the limb is supported by the water. This would include any horizontal motion such as horizontal shoulder abduction and adduction, in chest deep water. Buoyancy equals the force of gravity as the arm floats on the surface of the water. This is especially beneficial for hemiparesis following CVA, as decreased effort is necessary for shoulder movement.

The principle of relative density states that when a person is resting in water, partially or fully submerged, they experience an upward thrust, equal to the weight of the water displaced. Each person’s body composition affects relative density; therefore, we must take this into consideration when working with patients. The body’s composition of fat, bone and lean muscle has specific gravities that vary by age and sex. Those with more adipose tissue, decreased bone density and/or muscle mass tend to float while those with greater muscle mass and less body fat tend to sink in water. Factors that increase relative density (causing the object to sink) include spastic limbs, bulky muscular body, a tense fearful patient, kyphotic trunk alignment, disproportionate higher and lower trunk size (hydrocephalus), disproportionate limb/trunk ratio (short legs, long trunk, lower center of gravity) and deflated lungs. Factors that decrease relative density (causing the object to float) include flaccid limbs, high adipose body tissue, a relaxed patient and inflated lungs.

It is important to understand that relative density and buoyancy may adversely affect a patient with, for example, an upper-extremity amputation. Due to the specific gravity on the remaining limb, it may cause balance instability due to unequal relative densities on the two sides of the body. This is also altered with a CVA patient with resulting hemiplegia of the upper or lower limbs. A paralyzed arm and leg have much less muscle mass and less specific gravity.

Although there are many benefits to buoyancy, buoyancy can also create problems in the aquatic environment. For example, buoyancy will decrease the stability of the therapist and patient (particularly at increased depths). Stability will be further decreased for those patients or therapists with excessive adipose tissue. In addition to safety concerns, buoyancy may increase patient anxiety due to the feeling of decreased stability. Another concern with buoyancy is that patients’ flaccid extremities may float.

**Hydrostatic Pressure (HP)**
Hydrostatic pressure is the force or pressure that is exerted on any immersed object by the molecules of a fluid. This pressure will increase as the depth of the immersed object increases. According to Pascal’s law, fluid pressure is equally exerted on all surface areas of an immersed object (at rest) at a given depth. The pressure of the water on the body and its blood vessels causes arterioles to dilate and shift body fluids from the extremities back to the thorax. This principle is beneficial for those with CVA or mastectomy since HP decreases arteriole blood pressure, increases renal output and pushes out other metabolic end products.
Precaution must be taken though because increased depth will increase resistance on the chest wall. Hydrostatic pressure’s effect during chest immersion increases the effort needed to breathe by 60 percent. This is particularly important for those patients with Chronic Obstructive Pulmonary Disease (COPD) and similar diagnoses with breathing disorders. For these individuals, exercises can be modified by floating on the water’s surface in supine or prone with a snorkel to improve ventilation. In this position there is reduced weight of the abdominal organs on the diaphragm.

Hydrostatic pressure also serves to stabilize unstable joints. Patients can initially start therapy sessions in shallow water and move slowly deeper toward chest immersion. This allows patients to practice breathing and adjust to the hydrostatic pressure.

There are a variety of therapeutic benefits of hydrostatic pressure. Hydrostatic pressure provides benefits to the patient even before the patient begins moving in the water. Hydrostatic pressure aids the patient in decreasing/gating pain and edema, increases venous return, provides tactile input that can reduce tactile defensiveness (due to the constant generalized pressure) and assists with strengthening the muscles of inspiration while assisting the muscles of exhalation. Additionally, the hydrostatic pressure at a depth of 48 inches is around 88.9 mmHG. Since this force is slightly greater than diastolic pressure, it can help with the resolution of edema.

Hydrostatic pressure can be a problematic for patients with unstable blood pressure and/or patients with respiratory/vital capacity problems. In addition, patients may experience anxiety about feeling pressure on their chest.

**Resistance**

There are also a variety of therapeutic benefits of the resistant properties of water. One of its main benefits is that it provides numerous opportunities for strengthening and endurance. In addition, it can be useful for balance training and trunk stabilization as it allows for increased response time (for equilibrium reactions). There are concerns, though that the use of resistance can include vestibular problems (which may be caused by visual discrepancies/depth perception), tactile defensiveness (which can be caused by turbulence) and balance issues.

There are a variety of resistant forces found in the aquatic environment, including:

**Viscosity** -- this is the property fluid has (the friction between liquid molecules) that makes it resistant to flow. Liquid molecules adhere to each other as well as the surface of an object moving through it. Resistance increases as viscosity increases. Because water is more viscous than air, there will be more resistance to movement in the aquatic environment than on land. Viscosity decreases as temperature increases.

**Frontal resistance** -- is the horizontal force that acts on the body. The greater the surface area of the body part moving and meeting the water head on, the greater the resistance from drag.

**Surface tension** -- is the force between molecules on the surface of the water that acts like an elastic skin resisting a vertical force.

**Drag forces** -- are resistant forces that cause an object to move slowly through the water. Examples that act on the body in an aquatic environment include eddy drag, skin friction, and tail suction. Water flows from high to low pressure creating small whirlpools that exert a backward pulling force on the object. Resistance is affected by the speed of movement and the surface area of the object. Faster objects create more drag. Larger surface area also creates more drag.

**Turbulence** -- is the movement of water that creates resistance. With laminar (streamlined) flow, there is a continuous steady movement of fluid in a straight line where molecules are moving parallel to each other. Resistance is proportional to velocity with laminar flow. Turbulent flow describes the irregular, random movements that occur in water. With turbulent flow, resistance is proportional to velocity squared.
Factors that can impact resistance include:

- Increased surface area = increased resistance. For example, walking forward versus sideways, using a supinated forearm versus neutral position or using webbed gloves during UE motions
- Increased speed will increase resistance for strengthening. It’s important that full range of motion is emphasized before increasing the speed
- Combinations of fast and slow movements. At maximal effort, deep-water range of motion speeds are significantly slower than land range of motion speeds for equivalent energy expenditure
- Add force/power to the motion to increase strength. For example, in waist deep water, a slow “bunny hop” can be more challenging when concentrating on pushing with all your might with both feet against the pool floor harder and harder each time, attempting to bring the body vertically out of the water farther and farther with each repetition
- Changing direction to increase resistance and energy usage. Frequent changes of direction increase the work necessary to move against the water’s turbulence. Examples include traveling in random directions (forward, backward, laterally, zig-zags, circles, figure 8’s) and performing combination routines such as Jumping Jacks or Cross-country skiing.

The law of levers may be stated simply by saying that the moment of the lifting force must equal the moment of the force due to the load. The key to operation of a lever is the relative position of the load, the pivot called a fulcrum and the applied effort. To maximize the applied effort, the most effective placement of a fulcrum is close to the load. With regard to aquatics, this means that the longer the effort end of the lever the less force needed. We can grade range of motion or strength exercises by utilizing the principle of the law of levers, for example marching with flexed knees and progressing to full hip flexion; completing elbow circles and progressing to full arm circles or using a kick board to lengthen load arm.

**Water Temperature**

Water temperature is another factor influencing aquatic therapy. Depending on the type of patients or conditions therapists will need to determine whether to work in warmer or colder water temperatures.

For aerobic conditioning, 80-85 degrees is most appropriate (this is the temperature of most public pools). Working aerobically in this temperature provides a natural cooling effect, preventing heat exhaustion during fast-paced workout. In warmer water, heat exhaustion happens more quickly because of extra burden on the heart as blood carries oxygen toward the working muscles inside the body, as well as carries heat away towards the skin. By decreasing heat stress, it is easier to increase cardiovascular endurance.

Warm water (86-94 degrees) relaxes muscle spasticity to alleviate pain and increase joint ROM and decrease contractures, for any variety of conditions, including arthritis, cerebral palsy, shoulder rotator cuff conditions and many more. Warm water may even be used with children with autism, as it provides sensory input and calms them.

Cooler water is preferred by patients in the later phase of rehabilitation and athletes, where exercise programs are of higher intensity. Those with Parkinson’s disease and Multiple Sclerosis also prefer cooler water secondary to possible exacerbation of symptoms after working in warmer water. If your patients become easily overheated, you may wish to consider interval training, alternating exercise intensity levels from low to high every 10-15 minutes.

An ideal aquatic therapy temperature is a problematic concept based on the variety of activities and populations using a specific pool. Patients that are more likely to become chilled and want warmer temperatures are the elderly, patients with arthritis, and chronic pain or fibromyalgia patients. Unfortunately, at warmer temperatures, patients with cardiac issues, prenatal patients, obese patients, and patients with multiple sclerosis can be at an increased risk of overheating.

Treatment considerations may include decreasing the intensity or duration of a therapy session. On the other side, the therapist may provide the patient with a wet vest to increase warmth. Treatment sessions should not be performed in the pool if the water temperature is unsafe for the patient. Recommendations for water temperature vary as indicated in the following table:
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<thead>
<tr>
<th>Degrees</th>
<th>Recommended for</th>
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<tbody>
<tr>
<td>88-92</td>
<td>Low intensity activities</td>
</tr>
<tr>
<td>78-82</td>
<td>High intensity activities</td>
</tr>
<tr>
<td>86-93</td>
<td>Older population</td>
</tr>
<tr>
<td>81-90</td>
<td>Obese population</td>
</tr>
<tr>
<td>86-91</td>
<td>Heart conditions</td>
</tr>
<tr>
<td>92</td>
<td>Ideal for the masses</td>
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Water temperature should be based on:
- The patient population being treated (e.g., MS vs. arthritis)
- The treatment techniques used (e.g., gait training vs. manual techniques)
- Goals of treatment (e.g., decrease tone vs. strengthening)

**Establishing an Aquatic Therapy Program**

In order to achieve a successful aquatic therapy program for each resident, it is essential the interdisciplinary team (IDT) work closely together to:
- Identify and track residents who demonstrate functional deficits related to ROM, strength, balance, coordination, pain, endurance, posture or muscle tone, all of which can be treated in the aquatic environment
- Provide ongoing facility education regarding purpose and benefits of aquatic therapy
- Identify residents who have experienced a change in function or physical condition and who could benefit from skilled therapy services both on land and in the water
- Establish facility systems to notify therapy when functional changes occur
- Train facility staff to identify impairments impacting function and make appropriate therapy referrals
- Develop and implement systems for demonstration of resident function/status prior to discharge from therapy to ensure carryover of skills
- Schedule regular meetings/rounds (e.g., falls, restraint) and establish communication systems for all team members to access information from these meetings
- Develop and implement communication systems to ensure supportive documentation for therapy referrals and an IDT care plan

**Facility Education**

Facility staff training is essential for successful resident participation in an individualized aquatic therapy program. Topics for inservices or educational opportunities may include:
- Description/importance of the aquatic therapy program
- Importance of activity; physical/physiological effects on residents who are immobile/remain in bed
- Identification of signs and symptoms of functional decline/improvement, appropriate candidates and referral systems
- Activities carried over on land after discharge from the water environment
- Supportive nursing documentation and/or supervisory requirements by CMS for RNP, FMP and/or skilled rehab programs and IDT role in ensuring requirements are met
- Programs available to resident for carryover after discharge (e.g., Restorative Nursing and/or Functional Maintenance)
- Role of therapy, candidate identification, referrals and supporting documentation specific to facility physicians
Candidate Identification
As residents may vary in performance or functional activity tolerance at different times of the day, it is important to vary screening times throughout the day or month. Appropriate candidates for an aquatic therapy program are no different from those identified for traditional therapeutic intervention. They have observed deficits that can be effectively treated through the water medium.

Resident observation during daily activities (e.g., Grand Rounds, Admission/Quarterly Screens, restraint rounds, skin/wound rounds). Observe for:
- Poor strength or ROM (UE, LE, trunk)
- Poor trunk control
- Inability to perform leisure activities or ADL due to physical limitations
- Difficulty walking or standing due to ROM limitations and/or contractures
- Frequent falls or poor balance
- Residents who spend most of the day in their room in a chair or in bed
- Difficulty participating due to physical impairments
- Fine/gross motor control impairment
- Inability to cross midline
- Motor planning deficits impacting function
- Poor trunk control, positioning or body alignment
- Impaired sitting or standing balance
- Inability to adjust posture to meet task demand
- Impaired proprioception
- Abnormal tone
- Pain impacting ability to complete ADL
- Contractures
- Joint/weight bearing precautions
- Impaired cardiac/pulmonary function
- Neurologic impairment (e.g., hemiparesis)

Ask resident questions such as:
- Have you recently fallen?
- Are you comfortable in your chair?
- Do you have any pain or discomfort? When you move? When you’re sitting?
- Can you get around your room, to and from the dining room, etc.?
- Are you able to participate in activities?
- How much time do you spend in your wheelchair? Room? Bed at night?
- Have you noticed any changes or limitations in your ability to move?
- Do you have difficulty standing up from a chair? Getting on/off the toilet? In/out of bed? Completing your ADL? Going to activities?

Communication with Nursing and Activities Departments’ staff, family members and other primary caregivers regarding recent changes in resident’s physical or cognitive skills impacting the ability to transfer and ambulate. Ask specific questions, such as “Do you notice residents who:”
- Have decreased ability to bear weight
- Have declined in transfer, walking or ADL ability
- Demonstrate weakness of the legs, arms or trunk
- Have ceased participating in activities or who require more assist getting to/from activities and/or the dining room
- Complain of discomfort when in bed or chair
- Demonstrate tighter joints or decreased ROM
- Have repeated falls
Collect data from medical chart (e.g., nursing, activities, dietary and social service notes), and/or CNA records regarding changes in functional mobility, activity level, pain, etc.

**Appropriate Candidates for Aquatic Therapy**

- **Patients presenting with ROM or soft tissue limitation**
  - Reasons: Buoyancy assisted movements can assist with gentle ROM and with prolonged stretches using floatation equipment. The patient may have decreased pain perception during ROM and stretching and the relaxation effect of neutral warmth (depending on the pool’s temperature) enhances stretching.

- **Patients presenting with decreased strength or stability**
  - Reasons: Water can be utilized in all planes for strengthening as water acts upon all sides on the joint and every path of active motion is resisted. Water is more resistant to movement than air due to the properties of viscosity and drag and water exercises are isokinetic with water providing as much resistance as the patient applies. The therapist is able to progress the patient by having the patient add increased force to the movements.

- **Patients presenting with decreased weight bearing status or difficulty with weight bearing**
  - Reasons: Buoyancy provides an earlier return to closed chain activities which means earlier initiation of gait training. Different water depths in the pool allow for progressive weight bearing since percentages of weight bearing can be altered with changes in water depth and non-weight bearing exercises can be performed in the deep end with a buoyant device.

- **Patients reporting or presenting with chronic pain**
  - Reasons: The warm water (neutral warmth) encourages muscle relaxation and discourages muscle spasms. Reduced effects of gravity create reduced effects of joint compression and water may be the only environment the patient can perform necessary exercises. Water can reduce the sensitivity of nerve endings decreasing perception while hydrostatic pressure may help decrease delayed onset muscle soreness. Often, patients report 50 percent to 100 percent immediate pain reduction upon submersion into a water environment.

- **Patients presenting with balance impairments**
  - Reasons: Balance is constantly challenged in an aquatic environment due to turbulence and buoyancy. Balance can be further challenged by increasing the water depth with less fear of falling. Patients may be more willing to explore their balance boundaries in the aquatic setting.

- **Patients presenting with edema**
  - Reasons: Edema can decrease due to increased venous return from hydrostatic pressure (particularly in the lower extremities with increased depth).

- **Patients presenting with altered gait**
  - Reasons: Gait training can begin and occur without a traditional assistive device. Gait training can also occur in a safer environment and the property of buoyancy combined with a variety of water depths provides an opportunity to re-gait train a patient with progressive weight bearing.

- **Patients presenting with decreased positional sense**
  - Reasons: Hydrostatic pressure and drag forces provide increased sensory feedback and provide increased opportunities to explore movement in an environment with the potential for a decreased fear of falling.
• Patients presenting with deconditioned status or endurance limitations
• Reasons: The aquatic environment may be the only environment where the patient can participate or work on functional activities or work long enough to improve endurance and/or balance. Gentle water jogging/ambulation can provide a cardiovascular workout.

Indications for Warm Water Therapy
Warm water therapy (aquatics program) has many positive effects on the body and its various systems including:

• Improved circulation by:
  o Hydrostatic pressure
  o Vascular resistance reduced by 30%
  o Venus return increased by 32% cardiac output
  o Heart rate slows down approximately ten to seventeen beats per minute, due to longer filling time.
  o Blood absorbs oxygen more readily under partial pressure conditions, reduces the effects of Hypoxia.
  o Warm water and turbulence increase peripheral blood flow.
  o Considerable improvements in high blood pressure after just a few weeks of water therapy.
  o Increased blood flow provides more efficient cleansing of waste products from muscles and tissues.

• Weakened respiratory system improved by:
  o Water pressure on chest encourages stronger contraction of diaphragm and intercostal muscles.
  o Pressure reduces residual lung capacity, encouraging all lung surfaces to be used.
  o Encourages complete turnover of lung gases, stagnant residuals are exhaled.
  o Increase in oxygen blood gases due to the effects of partial pressure.

• Abnormal Muscle Tone/Tension improved by:
  o Warmth decreases gamma fibre activity, which inhibits muscle spindle activity allowing for a decrease in muscle tone and spastically.
  o Warm Water facilitates relaxation.
  o Slow active exercise promotes muscular relaxation.

• Pain improved by:
  o Relaxation of muscle tone/spasm.
  o Buoyancy reduces weight bearing through joints, trunk and extremities, without compression pressure from gravity and weight bearing, increased circulation is able to penetrate the interior of reach joint.
  o Constant low-grade sensory input can override pain stimulus.
  o Water therapy is indicated when land therapy is too painful.
  o Deconditioned clients often experience painful muscles from initial activity or therapy. These effects are minimized or non-existent in the water.

• Limited range of motion (ROM) improved by:
  o Improved circulation, muscle relaxation, decreased pain and weight relief improves ability of soft tissues to stretch.
  o Buoyancy can be used to assist a motion into greater range.

• Limited weight bearing ability improved by:
  o Buoyancy of water decreases weight throughout body. Muscles strengthen more easily without joint compression from load bearing stress.
  o Many buoyancy options are available 90%, 75%, 50% weight bearing.
• Weakness improved by:
  o Water can be used to assist, support or resist a movement so a wide variety of muscle strength grades can be treated.
  o Increase ROM, circulation, decreased pain and muscle tone allows for more effective range of strengthening.
  o Constant resistance of water helps to equally strengthen the working and opposing muscle groups.

• Decreased trunk stability, chronic lower back pain, weakness and imbalance improved by:
  o Deep-water exercise removes weight bearing and the effects of gravity and familiarity to land based muscle patterns. Muscle re-education occurs more readily in this new water environment. Gluts, quads, abdominals, and lower back must work in balance to maintain vertically. Verticality is progressively challenged with each appropriate deep-water or shallow water exercise.

• Muscle imbalance, such as, strong hip flexor, weak abs and gluts are improved by:
  o The constant and equal resistance provided by the water facilitates an improvement in muscle balance. Flexion and extension require equal muscle effort in water. Weak muscle will strengthen more readily in this environment.
  o The Aquatic specialist can further isolate and focus on strengthening weak muscle groups.

• Limited functional mobility improved by:
  o Decreased weight from buoyancy, increased ROM, decreased muscle tone and pain makes movements easier.
  o Support of the water increases confidence, ROM, and decreases abnormal muscle tone, pain/guarding and fear of falling.

• Impaired sensation improved by:
  o Hydrostatic pressure and turbulence increase sensory input, while producing all body message effect.
  o Swimming and water exercise facilitate bilateral movements, righting reaction, crossing midline and other sensory integrative activities.

• Perceptual/spatial problems improved by:
  o Water medium allows orientation to self.
  o Swimming strokes and water exercise allows bilateral activities, crossing midline, etc.
  o Creating turbulence around an extremity can increase awareness.
  o Turbulence can be used to challenge balance.

• Decreased ability to relax improved by:
  o Warmth of water
  o Improved ability to move muscles.
  o Recreational setting can be done with peers, goals can be achieved while incorporating enjoyable or play activities.

• Morale improved by:
  o Easier and more comfortable to perform exercise in the water, which is encouraging to the client.
  o A higher level of physical mobility can be achieved in the water.
  o It is easy to provide the client an opportunity to succeed in the therapeutic activities.
  o Provides clients an opportunity to socialize and be encouraged by others.
  o People are participating in a “normal” recreational activity.
  o Water therapy is available in the medical setting and the community setting. A continuation of service is available, adherence to health maintenance more likely.
• **Decreased aerobic fitness improved by:**
  o Water exercise/swimming can be performed by very low-level participants, progressions over a period of time can facilitate cardiorespiratory endurance training at varying intensities.
  o There is less joint stress in the water and clients can perform exercises that would not otherwise be possible.

• **To provide recreational opportunities via:**
  o Allow adults and children with disabilities to participate a leisure activity/sport, whereas on land may not be able to.
  o Exercise and play in the water can be fun (activities can be done in the form of play).

• **Improved safety:**
  o Learning at least the basic water skills (floating, righting oneself and breath holding) will help prevent panic and water accidents. Falling in the water is not injuries to bones or soft tissue.
  o Fully qualified instructors & lifeguards trained in water safety, lifesaving skills, CPR, and water exercise therapy techniques minimizes risk to clients.
  o Water slows down movement, allowing participants time to. Thus, preventing jerky or ballistic movements.
  o Injuries or re-injuries are rare in water.
  o Falling in water is less dangerous.
  o Passive rehabilitation contributes to muscle atrophy and loss of ROM. Water exercise is safe enough to start right after injuries and 7 to 10 days after surgery. A head start with water therapy can reduce recovery time and recovery needs.

• **Decreased post-menopausal bone loss:**
  o Recent studies indicate bone density improvements with feet on pool floor water walk or jog classes. Results are similar to weight training.
  o Muscle contractions pull on the bone attachment and stimulate bone production in those locations.

**Contraindications to Aquatic Therapy**
Individuals with contraindications should not participate in an aquatic program with therapy. Contraindications to aquatic therapy include:

- Diarrhea
- Vomiting
- Uncontrolled seizure activity
- Unstable angina
- Vital capacity of 1 liter or less -- Vital capacity needs to be sufficient to tolerate chest wall expiration against water pressure. Water pressure is 14.7 pounds per square inch at surface and increases by 0.43 pounds for every foot in depth. For this reason, these individuals may choose to stay in very shallow water and progress over time.
- DVT
- Patients with severe impulsivity
- Oxygen dependence
- Ventilator dependence
- Uncontrolled blood pressure, especially hypotensive patients
- Inability to regulate body temperature without compromise
- Incontinence of bowel
- All infections including contagious skin rash/infection, fever higher than 100 degrees or waterborne disease such as typhoid or cholera
- Severe burns
Precautions for Aquatic Therapy
These precautions should be taken into account when designing an aquatic program for an individual. Each facility/pool must decide which of these patients can enroll in a program and which should be precluded. Precautions include:

- Past medical history of seizures
- Muscular sclerosis if the water is over 88 degrees
- Vital capacity of 1.0 – 1.5 L -- Vital capacity needs to be sufficient to tolerate chest wall expiration against water pressure. Water pressure is 14.7 pounds per square inch at surface and increases by 0.43 pounds for every foot in depth. For this reason, these individuals may choose to stay in very shallow water and progress over time.
- COPD
- Cardiac conditions
- Autonomic dysreflexia
- Impaired cough reflex
- Patients with muscular sclerosis if the water is over 88 degrees
- Patients with respiratory diseases such as asthma; since chest compression, chorine/bromine or humidity can trigger an attack
- Fear of water
- Open wounds or surgical incisions (may require bio-occlusive dressing)
- Urinary incontinence (may use swim diapers or catheter)
- Abnormal blood pressure
- Recent radiation treatment (within the last three months) -- If undergoing radiation or using long term steroids, skin needs to be monitored closely for water effects
- Perforated eardrum -- If a patient has a history of perforated eardrums, patient must use earplugs or not submerge ears
- Menstruation without protection
- Diabetes
- Open wounds or surgical incisions
- If diagnosed with cerebral hemorrhage, it is recommended that the patient should not enter water until at least 3 weeks after evidence that bleeding has ceased
- Vertigo
- Kidney disease
- Behavior problems
- Water temperatures over 94 degrees -- Water temperatures this high can cause cardiac problems
- Tracheostomy
- Hypersensitivity to pool chemicals
- Pregnant patients (must have clearance from physician)
- Patients with HIV (because of the patient’s compromised skin and lung vulnerability to opportunistic infections)

Screening
A resident who presents with one or more of the following may be appropriate for PT or OT evaluation and treatment for aquatic therapy:

- Decline/change in ADL performance
- Muscular weakness
- Impaired proprioception
- Impaired cognition
- Abnormal tone
- Balance deficits
- Hemiplegia/paresis
- Pain
- Contractures
- Joint/weight bearing precautions
• Impaired cardiac/pulmonary function
• Neurologic impairment

Evaluation
An initial evaluation should be completed addressing all areas. It is important to perform a complete resident assessment to determine how to best address the resident’s functional deficits and how best to incorporate aspects of an aquatic program. It is important that the initial evaluation be completed ON LAND and not in the water. Identification of the root cause of functional deficits (e.g., strength, ROM, balance, visual-perceptual, sensory, endurance, cognitive, etc.) directs the therapeutic/aquatic effort. The evaluation will include both pool and land-based goals. The following areas should be assessed:

1. Gait analysis
   • Deviations
   • Use of assistive device
   • Distance
   • Level of assist
   • Safety awareness

2. Changing surfaces
   • Gait on level or even surfaces (e.g., tile, carpet)
   • Gait on uneven surfaces (e.g., grass, gravel, ramp, sand)
   • Transfers to/from surfaces of various heights and firmness (e.g., couch)

3. Balance and posture
   • Sitting, both static and dynamic
   • Standing, both static and dynamic
   • Balance reactions/Righting reactions
   • Protective extension
   • May use standardized tests (e.g., Berg, TUG, Functional Reach)
   • Lateral leaning
   • Retropulsion/backward leaning
   • Forward flexed

4. Transfers
   • Supine <> sit
   • Sit <> stand
   • Toilet
   • Tub/shower
   • Up from/down to floor
   • Use of assistive device
   • Level of assist
   • Safety awareness

5. Bed mobility
   • Rolling
   • Scooting in supine and sitting
   • Bridging
   • Ability to reposition
   • Use of trapeze or siderails
6. A/PROM
   - UEs (shoulder, elbow, wrist, hand)
   - LEs (hip, knee, ankle)
   - Trunk (cervical, thoracic, lumbar)
   - Contractures

7. Strength
   - Manual muscle test
   - Functional strength (consider UE and LE functional strength tests)
   - Activity tolerance

8. Pain
   - At rest
   - With activity
   - At worst
   - Location
   - Intensity (use objective scale)
   - Aggravating and relieving factors

9. Sensation
   - Proprioception
   - Kinesthesia
   - Light touch
   - Sharp/dull
   - Hot/cold
   - Compare R and L
   - Check specific dermatomes and sensory nerve distribution
   - Identifying and localizing input
   - Midline orientation
   - Vestibular input

10. Visual-perceptual
    - Neglect
    - Visual field cut
    - Body awareness – scheme and position in space
    - Right/Left discrimination
    - Depth perception
    - Visual motor skills
    - Safety when maneuvering in congested areas
    - Low vision

11. Coordination
    - Ataxia
    - Dysmetria
    - Disdiadochokinesia
    - Akinesia
    - Festinating gait
12. Tone
   • Flaccidity
   • Spasticity
   • Clonus
   • Rigidity
   • Synergy pattern
   • Consider using objective scale (e.g., Modified Ashworth)

13. Skin integrity
   • Bony prominences
   • Pressure areas/sores
   • Weight bearing
   • Pink/reddened areas
   • Rashes
   • Edema
   • Open wounds

14. Cognition/Behavior and communication
   • Safety
   • Impulsivity
   • Lethargy
   • Ability to follow commands
   • Sequencing
   • Orientation
   • Ability to call for help
   • Ability to talk with others
   • Use of call bell
   • Identification of wants and needs

15. Self-care/ADL skills including continence

16. Prior level of function -- should specifically address what the resident could previously do functionally and how current impairments impact this

17. Reason for referral and nursing support for intervention. Examples of supportive nursing documentation may include:
   • Resident demonstrates decreased ability with transfer sit to stand.
   • Resident is unable to complete lower body dressing. Requires staff assist.
   • Resident requires staff assist to complete pericare during toileting because resident is unsteady.
   • Resident demonstrates decreased range of motion in upper extremities limiting completion of upper body dressing

18. Past medical history including medications impacting plan of care and any history of falls
**Evaluation Tools**

Standardized evaluation tools may be used to assist in establishing current baseline abilities and/or documenting changes in physical status. These may include, but are not limited to the following:

<table>
<thead>
<tr>
<th>Evaluation Tool</th>
<th>Purpose/Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Berg Balance Measure</td>
<td>Designed to test levels of balance and fall risk in the elderly</td>
</tr>
<tr>
<td>Tinetti Assessment Tool</td>
<td>Designed to measure gait, balance and fall risk</td>
</tr>
<tr>
<td>Get Up and Go/Timed Up and Go</td>
<td>Measures sense of balance and fall risk</td>
</tr>
<tr>
<td>Dynamic Gait Index</td>
<td>Assesses the likelihood of falls in the elderly based on eight facets of gait</td>
</tr>
<tr>
<td>6-Minute Walk Test</td>
<td>Measures the distance a resident can quickly walk on a flat, hard surface in a</td>
</tr>
<tr>
<td></td>
<td>period of 6 minutes</td>
</tr>
<tr>
<td>Gait Assessment Rating Score Modified (GARS-M)</td>
<td>Measures qualitative aspects of gait and their relationship to falls</td>
</tr>
<tr>
<td>Rhomberg/Sharpened Rhomberg</td>
<td>Measures vestibular input with some sensory overlays for residents having</td>
</tr>
<tr>
<td></td>
<td>difficulty finding midline or holding a static standing posture</td>
</tr>
<tr>
<td>Functional Knee Evaluation</td>
<td>Measures knee function in adults with rheumatoid arthritis and mild deformity</td>
</tr>
<tr>
<td></td>
<td>or joint replacements; 85+ points = excellent, 70-84 points = good, 60-69 points =</td>
</tr>
<tr>
<td></td>
<td>fair, &lt;60 points = failure</td>
</tr>
<tr>
<td>Pain Disability Index</td>
<td>Measures pain-related disability during activities of daily living</td>
</tr>
<tr>
<td>Pain Rating Scale</td>
<td>Measures pain based on facial expression or a patient-assigned numeric value</td>
</tr>
<tr>
<td>Short-Form McGill Pain Questionnaire</td>
<td>Depicts sensory and affective dimensions of pain as well as pain intensity</td>
</tr>
<tr>
<td>Harris Hip Score</td>
<td>Designed to assess the level of pain and functional impairment of hip replacement</td>
</tr>
<tr>
<td>Functional Reach</td>
<td>Measures the maximal distance one can reach outside his/her base of support</td>
</tr>
<tr>
<td></td>
<td>while maintaining a fixed base of support in standing and predicts risk for falls</td>
</tr>
<tr>
<td>Nudge/Push</td>
<td>Measures anticipatory postural control and automatic postural response in quiet</td>
</tr>
<tr>
<td></td>
<td>standing</td>
</tr>
<tr>
<td>Postural Sway</td>
<td>Measures volitional control of center of gravity (COG) in quiet standing</td>
</tr>
<tr>
<td>AROM/PROM Goniometric measurements</td>
<td>Measures degrees of range of motion per plan of movement per joint</td>
</tr>
<tr>
<td>Manual Muscle Testing</td>
<td>Measures gross strength per joint movement</td>
</tr>
<tr>
<td>Brunnstrom Muscle Tone Scale and Stages of Recovery</td>
<td>Assists to identify tone and synergy patterns in hemiplegic residents</td>
</tr>
</tbody>
</table>

**Selected ICD-10 Treatment Codes**

ICD-10 treatment code selection should correspond to the impairment/condition requiring skilled services and identified at the time of resident evaluation. One should consult the ICD-10-CM Manual for a list of current and applicable codes.

**Skilled Documentation and Medical Necessity**

Documentation must show more than practice or repetitive aquatic exercises. It should demonstrate the clinical judgment behind the use of the aquatic medium in treatment, specific techniques and strategies used and medical necessity for these choices. **Documentation must support the need for skilled services** with objective data to define:

- Specific muscle weakness or paralysis
- Limited range of motion
- Pain
- Spasticity
- Impaired coordination
- Improper adjustment of current assistive devices
- Decreased activity tolerance
- Lack of selective control
- Joint or ligamentous instability
Appropriate skilled terminology is used when documenting the evaluation, daily notes, progress reports and discharge summaries. Progress, skilled service, barriers to function and rationale need to be documented. To reflect skilled services, document assessment, modification, adaptation or facilitation of the:

- Intervention
- Technique
- Feedback, including type and amount
- Environment

**Skilled Interventions**

Treatment interventions should indicate clinical reasoning and the skill of therapist related to the resident’s difficulty with functional tasks, impairments related to these and specific aquatic interventions. Clinical documentation must reflect specific skilled service provision to facilitate task performance, including but not limited to skilled procedures and modalities, which, in general, include:

- Analysis of resident’s response to skilled techniques
- Analysis of resident’s response to adaptive equipment or assistive devices to improve independence within the environment
- Re-evaluation and/or updates/modifications to initial Plan of Care
- Education and training for functional task performance
- Integration of the aquatic and land-based programs
- Establishment of a functional maintenance or restorative nursing program

Documentation must correspond to and address the impairment/condition interfering with the resident’s function. Documentation must describe specific skilled interventions, techniques and strategies. These may include, but are not limited to:

- Dynamic activities including the use of balance strategies, strengthening and range of motion techniques to improve performance of a functional task or activity
- Graded physical assist for activities (e.g., bed mobility, transfers). Include type and amount (%) cueing required for task.
- Weight shifting to improve safety with unsupported sitting or standing
- Postural awareness/alignment training
- Balance strategies and retraining
- Anticipatory reactions
- Standing pivot transfer with emphasis on weight shift/direction change
- Adaptive equipment training (e.g., transfer to commode chair, tub bench)
- Adaptive transfer techniques (e.g., sliding board transfer)
- Instruction in compensatory strategies during standing, sitting or transfer activities for:
  - Visual field/visual perceptual deficits
  - Body awareness deficits/neglect
  - Sensory loss
  - Cognitive deficits
  - Unilateral weakness
  - Balance deficits
  - Pain
  - Spinal deformity
  - Stairs/curbs
  - Maneuvering around obstacles
  - Task initiation/progression/sequencing
  - Vary surfaces (e.g., foam, gravel, inclines, grass, sand)
  - Accurate foot/hand placement
• Weight shift/dynamic stability altering base of support
• Direction changes while walking/pivots
• Gait cycle
  o Weight acceptance—initial contact/loading response
  o Single limb support—mid-stance/terminal stance
  o Swing limb advancement—pre-swing/initial swing/mid-swing/terminal swing
• Proprioceptive, tactile, kinesthetic facilitation technique provided throughout the entire activity
• Assessment, modification or adaptation of assistive devices used to achieve optimal independence with transfers and ambulation
• Staff and/or family/caregiver education and training with the resident for demonstration of competency, adaptation and/or environmental techniques

Skilled Documentation
As payers scrutinize charges for aquatic therapy more closely, the most important thing therapists can do to maximize reimbursement is to appropriately select patients for therapeutic interventions in the aquatic environment. Therapists must determine whether the interventions being provided in the aquatic environment are truly skilled in nature.

Skilled patient selection requires:
• The clinical reasoning and decision-making skills of a licensed physical or occupational therapist
• That the patient has impairments and disabilities which can be minimized or eliminated with aquatic therapy
• That the patient has the potential for achieving the stated goals/outcomes which improve quality of life and ease burden of care
• That the patient is unable to safely participate in a traditional therapy program on land due to weight bearing limitations, severe weakness, pain or decreased ROM
• That the patient would benefit from the therapy in the aquatic environment because of the unique properties of water
• That the intervention in the aquatic environment will enable the patient to transition to an exercise or functional training program on land and possibly facilitate an overall shorter episode of care

Clinical examples of skilled therapy:
• Patient with arthritis who cannot ambulate on land because of the inability to use an assistive device but who can begin walking in the pool
• Patient with THR with weight-bearing restrictions who cannot follow these precautions safely on land
• Patient with Guillain Barre who is too weak to exercise on land but who can move in the pool with buoyancy assistance.

Examples of non-skilled services
• Water walking or jogging programs for cardiovascular conditioning for fitness
• Exercise programs to maintain function rather than improve it
• Swimming programs for patients with difficulty using community pools either due to access or temperature

Skilled documentation related to an aquatic therapy program should:
• Use terms such as buoyancy assisted, buoyancy resisted, or buoyancy supported to describe activities and clearly identify progress
• Clearly identify progress made in pool and its translation to land, for example:
  o Proper weight bearing during mobility
  o Gait sequencing skills
  o Less pain during ADL
  o Decreased edema
  o Improved functional activity tolerance
  o Increased functional mobility skills
• Measure repetitions completed per minute to identify progress in speed against water turbulence
• Clearly describe what type of equipment used and its purpose
• Measure edema before and after treatment to document the effects of hydrostatic pressure
• Clearly describe any compensatory patterns and accessory movements the patient has
• Contain a rationale statement of how aquatic medium might improve deficits
• Describe the effects of water on tone reduction, improvements in ROM or strength and gait quality

Examples of skilled documentation:
• Immediately able to initiate upright activities in water by adjusting water level due to buoyancy principles
• Ambulating 10 feet first session, properly sequencing standard walker in pool with minimum assist of 1 and moderate verbal cues, PWB on right LE
• Patient upright 30 minutes without c/o pain/discomfort in B LEs due to joint support, relaxation and improved circulation in water
• Decreased RLE edema from X to X circumference around malleoli due to hydrostatic water forces

CPT Coding
97113 Aquatic therapy with therapeutic exercises

• This procedure uses the therapeutic properties of water (e.g., buoyancy, resistance) and describes any therapeutic exercise, activity, neuromuscular reeducation or gait activity performed in a water environment
• The procedure may be reasonable and medically necessary for a loss or restriction of joint motion, strength, mobility, or function, which has resulted from a specific disease or injury.
• May be appropriate for patients who do not tolerate land exercises or who require the buoyancy or resistance properties of water
• This requires direct (one-on-one) patient contact. However, the therapist does not have to be in the water. This code is to be used for any exercise performed in a water environment.
• Documentation should include objective findings related to joint motion, strength, or mobility impairments (e.g., degrees of motion, strength grades, levels of assistance) and reflect the medical necessity of the treatment in a water environment. Other forms of exercise therapy may be medically necessary in addition to aquatic therapy.
• Do not report aquatic therapy and the type of therapeutic exercise separately. Code ONLY the aquatic therapy with therapeutic exercise (97113). This code should not be used in situations where no exercise is being performed in the water environment (e.g., debridement of ulcers). It is considered not medically necessary to have more than one form of hydrotherapy during a visit.
• The frequency and duration should be what is clinically appropriate based on barriers to function, functional deficits, complications, etc.

Daily/Weekly Documentation should include:
• Justification for use of a water environment
• Objective loss of ADLs, mobility, ROM, strength, balance, coordination, posture and effect on function
• If used for pain include pain rating, location of pain, effect of pain on function
• Specific exercises/activities performed (including progression of the activity), purpose of exercises as related to function, instructions given, and/or assistance needed to perform exercises to demonstrate that the skills and of a therapist were required
• Objective findings related to joint motion, strength, or mobility impairments (e.g., degrees of motion, strength grades, levels of assistance) and reflect the medical necessity of the treatment in a water environment
Discharge
Patients not continuing their water-based program as a maintenance program should be transitioned to a land-based
program as soon as reasonably possible for the patient’s condition. Transition the activities to an independent (or
caregiver-assisted) aquatic program. Ensure that patient, staff or family training is completed prior to discharging the
resident from rehab services. Follow-up instructions need to be in written form and individualized. Therapy should
monitor functional status through rehab-restorative meetings, nursing communication, screens and Quality Measure
reports.

The therapist must select and justify activities that will be performed in the pool and ensure that there is no duplication
between pool and land. This does not mean that the patient cannot be working on an activity in the two environments
so long as the difficulty or constraints of the task are different. Progressions in function in the pool should result in
coinciding functional progressions on land.

- Total spine unloading can be discharged when able to walk and make movements of trunk in nipple deep water
- When the patient can walk in water at depth of ASIS, then ready for gait training on land
- When weight bearing restrictions are removed and patient can exercise buoyancy resisted and no restrictions to
attaching external devices, then can discharge aquatic
- Progress from streamlined exercise to producing turbulent flow
- When able to move in turbulent flow in a variety of positions, may discharge aquatic
- Combine pool and land-based therapy deciding which activities are best performed in each environment --
some exercises are best performed with hydrodynamic principles
- Remember the patient can return to the pool later if needed
- Discharge when gains in pool do not carry over to land or when patient fails to make progress in pool

Pool Equipment

Mandatory equipment needs
- Oxygen tank (portable)
- Backboard
- A US Coast Guard approved Ring Buoy or Torpedo Buoy with attached throw rope with a length at least equal to
the maximum width of the swimming pool or 50 feet, whichever is less
- Complete first aid kit -- shelf life must be current and should contain
  - 2 units -- 3” bandage compress
  - 2 units -- eye dressing packet
  - 1 unit -- scissors/tweezers
  - 1 unit -- adhesive tape 1”
  - 1 box various sized Band-Aid
  - Antiseptic
  - 2 pairs latex gloves
  - 1 CPR barrier shield
- Access to emergency call switch or phone for emergency
- Blood pressure cuff and stethoscope
- Fire alarm switches (if indoor pool)
- Emergency access evacuation sign posted (if indoor pool)
- Universal precautions kit (gloves, mask, disinfectant, plastic bag, goggles, etc)
- Emergency lighting system (if indoor pool)
- Life hook or Shepherd’s crook at least 12 feet in length
Recommended additional items for safety

- Cervical collar
- Treatment available for hypoglycemia

Therapy specific equipment

Use of equipment will depend on what type of treatment provided, the population treated and the purpose of the equipment. Some commonly used therapy equipment includes the following:

- Inflatable neck collar -- Useful for Bad Ragaz patterns and necessary for clients with decreased head control
- Wands -- Hollow “sticks” that can be opened or closed to increase resistance
- Buoyant cuffs -- Beneficial for ankles or wrists to enhance the natural buoyancy and resistance of water. Can be used while prone or supine in the water for simple floatation or while standing for buoyancy assisted motions toward the surface of the water to gain end range shoulder or hip motion. Can also be used for buoyancy resisted muscle toning moving away from the surface of the water.
- Deep-water floatation belt/Aqua jogger -- Long foam belt with buckle for around the waist used for buoyancy. Ideal for patients who lack trunk stability. In deep water, can be used for jogging or LE open chain activities. Can be turned around with the wide portion in front to provide abdominal support, muscle re-education, upper trunk alignment and posture. Used in all Bad Ragaz patterns.
- Kickboards -- Typically used by the arms but can be used for balance and strengthening of the legs by athletes or higher-level patients, where safety is not such an issue. The kickboard benefits by use of the surface area principle when used underwater; or by the buoyancy principle if used only at the surface. Can be used for resistance (e.g., for the upper extremities if held under water) or buoyancy (e.g., to support the body in prone for lower extremity exercise)
- Inner tubes -- Donut shaped floatation devices designed to support the body around the waist in vertical, supine or prone positions
- Step -- Can be placed on the pool floor for stepping to improve lower extremity function or for practice of repeated steps to improve lower extremity function, such as after a knee replacement.
- Noodles -- Used for buoyancy, strengthening, stretching
- Floating parallel bars -- Can improve safety while walking in water and decrease fear of falling
- Wrist and ankle weights -- Provide resistance for strengthening or stability, proprioceptive feedback, traction in deep water and assist flaccid extremities with weightbearing
- Bench -- Can be placed in the shallow end to work on seated UE exercise
- Aquatic shoes -- Protect skin, provide support, improve footing
- Webbed gloves/ Aqua gloves -- Form-fitting neoprene webbed material used for strengthening to increase hand resistance by 50%. Increase surface area of UE moving through the water.
- Aqua fins -- Used on the wrists or ankles. Can be adjusted to increase the resistance to increase muscular strength.
- Buoyant resistance bells -- For buoyancy or resistance. Ideal for upper body conditioning underwater as they increase resistance for horizontal or downward movements. Can provide support or act as an assistive device during stance/gait. Some models feature graded resistance from 40% to 80% so you can adapt to the patient and their specific level of rehab. These will not absorb water, therefore eliminating mold and mildew buildup.
- Swim fins -- Used for lower body workout. A special exercise you can perform to enhance dorsi-flexion for foot drop or tight calves is to simply walk back and forth across the shallow end of the pool, concentrating on picking up your toes.
- Water walkers -- Used for resistance/endurance. Used for a variety of resistance workouts including cardio, fat burning, rehab for sports injuries or general leg strength building. They are strapped to the feet; the wings plane out during downward motion for zero-impact resistance... and deplane upward for minimal resistance. Generally used in conjunction with a floatation belt.
Entries and exits
There are several options for pool entries and exits. One option is a hydraulic lift with a hose. When using this device, it is important to keep the hose out of the way for transfers and check for weight load limits. Another option is a “zero depth” ramp with a handrail or handrails. Permanent steps (with one or more handrails) are also an option. While ladders may be available, ladders are rarely used. Ladders are appropriate for high functioning patients only and are not very practical in the therapeutic setting.

Deck safety
Deck surfaces are often wet and potentially slippery. Pool shoes can improve traction and help protect feet. All equipment should be picked up to avoid a tripping hazard. The therapist may want to consider an assistive device on deck for patients even if they do not typically use one. To maintain safety for all, the pool should post operating hours and when not open should be locked with restricted access. Most states do not require therapists to be certified and/or a lifeguard present for therapeutic interventions. Check with state specific guidelines and follow that which is most strict.

Chemicals
The following are general guidelines for pool chemicals and safety. Please check with state specific guidelines for further information and follow whichever is most strict. It is recommended that chemicals are tested at least twice a day in the morning at pool opening and again at pool closing. If the pool sees heavy use throughout the day, additional chemical readings should be taken at various intervals.

Water Quality

1. Testing Equipment
   • Water testing equipment for determining pH and disinfectant level of pool water shall be provided. The equipment for determining pH shall include at least five color standards with a range of pH 6.8 to 8.0, as a minimum.
   • Where chlorine is used as a disinfectant, a DPD-type test kit shall be provided that includes at least four chlorine color standards with a range of 0.5 to 3.0 p.p.m., as a minimum.
   • Where bromine is used as a disinfectant, a colorimetric test kit shall be provided that will determine free bromine residual and pH. The test kit shall include at least five bromine standards covering a range of 1.0 to 5.0 p.p.m.
   • Pools using chlorinated cyanurates for disinfection shall have a test kit to measure cyanuric acid concentration. The cyanuric acid test kit shall permit readings up to 100 p.p.m.
   • Where silver/copper or copper ion generators are used, a test kit to determine the concentration of copper shall be provided.

2. Disinfectant Residual.
   • Where chlorine is used as a disinfectant, the chlorine residual shall be maintained between 1.0 and 4.0 p.p.m. as free chlorine residual. A free chlorine residual of at least 2.0 p.p.m. shall be maintained when the pool water temperature exceeds 85° F.
   • Where bromine is used as a disinfectant, abromine residual shall be maintained between 2.0 and 8.0 p.p.m. as total bromine. A bromine residual of at least 4.0 p.p.m. shall be maintained when the pool water temperature exceeds 85° F.
   • Where chlorinated cyanurates are used, the cyanuric acid concentration shall not exceed 100 p.p.m.
   • When combined chlorine in excess of 0.5 p.p.m. is detected, the pool shall be superchlorinated to attain a free chlorine concentration of at least 10 times the combined chlorine concentration or oxidized by other means to eliminate the combined chlorine.
   • Where silver/copper or copper ion generators are used, the concentration of copper shall not exceed 1.3 p.p.m. and the concentration of silver shall not exceed 0.05 p.p.m.
• Where ozone is used, the ambient air ozone concentration shall be less than 0.1 p.p.m. at all times either in the vicinity of the ozonator or at the pool water surface.

3. pH. The pH of the pool water shall be maintained between 7.2 and 7.6.

4. Turbidity. The pool water shall be sufficiently clear that the entire pool basin is clearly visible from the pool deck.

5. Alkalinity. The alkalinity of the pool water shall not be less than 50 nor more than 200 p.p.m. as calcium carbonate.

6. Temperature. The pool water temperature for indoor swimming pools shall not be less than 76° F. nor more than 92° F. Air temperature at an indoor pool shall be higher than the water temperature.

7. Salt chlorinators are available for pools. However, salt is not a disinfectant or sanitizer. Salt does not kill bacteria, inactivate viruses, or breakdown undesirable organic material in pool water. Free chlorine is what disinfects or sanitizes pool water and it is strongly recommended it is used. If the facility has a population with an allergy or otherwise adverse reaction to chlorine, other chemical substitutes should be considered.

Guidelines for Pool Exercise
• Encourage maintenance of trunk stability. Encourage ‘normal’ erect posture.
• Exercises are performed in a fluid, rhythmical pattern without stopping at any point in the range of motion
• Keep moving body parts underwater. If limbs come out of the water, resistance is decreased.
• Since speed is related to strength and the ability to stabilize, the patient is encouraged to increase the speed of movements as they are capable
• Difficulty can also be increased by increasing the excursion of movement. Gradually increase the range of motion as tolerated.
• Resistance can be increased by the addition of certain devices (paddles, floats, etc)
• Duration of exercise should be short at first and gradually increase allowing time to adapt to the regimen
• Pain is usually an indication that something is wrong and should be corrected
• Activities usually involve gross movements with long level arms for maximal benefits from the water

<table>
<thead>
<tr>
<th></th>
<th>Initial Level</th>
<th>Difficult Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Depth of water</td>
<td>Deeper water more support</td>
<td>&gt;&gt;&gt; Shallow water less support</td>
</tr>
<tr>
<td>Stabilization</td>
<td>Unilateral movements most stable</td>
<td>&gt;&gt;&gt; Bilateral movements less stable</td>
</tr>
<tr>
<td>Kinematics</td>
<td>Closed chain less balance required</td>
<td>&gt;&gt;&gt; Open chain more balance required</td>
</tr>
<tr>
<td>Speed of movement</td>
<td>Slow less resistance</td>
<td>&gt;&gt;&gt; Fast most resistance</td>
</tr>
<tr>
<td>Complexity of movement</td>
<td>Straight plane movement simplistic</td>
<td>&gt;&gt;&gt; Oblique plane movement complex</td>
</tr>
</tbody>
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Phases of Aquatic Rehabilitation
1. Phase I -- Acute or Post-surgical phase
   • Decreased function secondary to pain, swelling, and inflammation
   • Warm water stimulates healing process
   • Warm water decreases pain, edema and inflammation.
   • With physician approval, may participate with open wound with waterproof Bioclusive dressing
   • Phase I exercise objectives may consist of:
     o Slow, gentle PROM and/or AAROM of the immediate proximal and distal joints to the affected area of the body, (provided that the physician has not stated otherwise). The patient should never lock a joint, as to protect unnecessary strain. Avoid full extension of the elbows and knees.
     o Gentle stretching of the affected part of the body.
Slow, gentle ROM of the affected area, monitoring patient’s pain closely and using only the water’s resistance (no buoyancy equipment or weights). The patient should always gain functional ROM of a joint before using resistive equipment.

- In cooperation with aquatic therapy, may use other modalities to decrease pain and increase exercise tolerance (ice, ultrasound, E-Stim, traction).

2. Phase II - Early exercise phase
   - Symptoms of pain, swelling and loss of function have generally improved to a moderate level
   - Phase II exercise objectives may include:
     - Gentle stretching
     - Active ROM exercise with buoyancy assisted or supported equipment against the water’s resistance
     - Muscle contraction with very limited pain
     - Reconditioning muscle strength and endurance around the affected area

3. Phase III - Intermediate Exercise
   - Pain, swelling and functional loss are improved
   - Affected area strength, ROM at 50% of pre-morbid values
   - Exercises include:
     - Moderate stretching
     - Resistive exercises incorporating progression through turbulence, speed and surface area principles
     - Motions of full range of motion

4. Phase IV – Advanced Exercise
   - The goal here is to enhance muscle strength, endurance and ROM to 90% of the prior level of function
   - Objectives of Phase IV may include:
     - Exercise to enhance full ROM and flexibility
     - Maximal repetitions for enhancement endurance
     - Exercise for improving coordination
     - Exercise using maximal resistive equipment such as buoyant dumbbells, weights, Theratubing, kickboards etc. The equipment used in the pool should only be used for the purpose that it was designed for. It should be made of a material that is resistant to bacterial growth, especially in a warm water therapy pool of 90 degrees or more

5. Phase V – Advanced Exercise
   - The final phase is integration from water into a land-based program for maintenance of function. This home program may be a community-based class such as aquacise at the YMCA.

Each of the stated phases takes different times to meet. Generally speaking, a patient is ready for the next phase if he/she tolerates the indicated exercise three separate sessions with only minimal pain or adverse effects.
Aquatic Health Concerns

1. Skin integrity
Problems with fungus or dry skin can occur. Encourage washing with soap, thoroughly drying skin, and possibly using lotion. Shoes can be used for foot protection.

2. Respiratory concerns
This is due to high content of chlorine/bromine pool chemicals in the air. Some patients may not be able to tolerate it. Ventilation systems should be in good working order.

3. Dehydration
Fluid needs will be higher for the patient and the therapist.

4. Pressure on abdominal contents
Patients or therapists may have to plan for smaller meals prior to entry or have mealtime earlier in the day.

5. Hypothermia or overheating
Any temperature below body temperature will take off body heat. Non-mobile SCI patients, young children, and the elderly are at higher risk for hypothermia. Wet suits may be a consideration. A therapist with extended pool time during the day can be at risk for hypothermia or overheating depending on the pool’s water temperature. Spending time treating from the deck may be a consideration. See contraindications and precautions for more details.

6. Vocal cords
An additional concern for a therapist is overusing her voice. Pools tend to be noisy and the therapist may find herself yelling to be heard for many hours of the day. To protect her vocal cords, the therapist can use nonverbal cues, use a microphone (if not in the pool), move closer to the patient, and keep the vocal cords hydrated.

Exercise Progression

Warm Up
- Applicable for all patient populations
- Warm up – prior to initiating exercises, allow the patient to move slowly in water, with assistance, as needed. The warmth of the water will promote increased circulation, and relaxation for stretching. This will reduce pain, increase joint ROM, decrease hypertonicity, and decrease potential for injury.
- Start with small gentle ranges of movement, progressing as tolerated
- Rotary warm up exercises with assist to break up extensor tone in trunk and facilitate more normalized tone in extremities
- Adjust water height to appropriate weight bearing status if limited

Progressions for Strength
There are a variety of ways to progress an aquatic treatment session or a specific therapeutic intervention in the aquatic environment. A simple way to increase resistance for strengthening is to have the patient perform a strengthening activity at a higher speed. Another way to progress a strengthening activity is to utilize buoyancy when positioning the patient for strengthening movements and encourage downward (against buoyancy movements). An example of a strength progression with buoyancy is: movement toward the surface, then horizontal movement, then movement toward the bottom of the pool.

Also, the therapist can increase resistance by having the patient increase the frontal surface area moving through the water. For example, instead of the patient slicing through the water with the palm facing down (when performing horizontal shoulder adduction) the therapist can instruct the patient to perform the movement with the palm facing medially, thereby increasing the surface area of the body meeting and moving through the water. Another way to increase resistance for strengthening in the aquatic environment is to instruct the patient to utilize a longer lever arm when moving an extremity through the water. For instance, after the patient is successful with performing horizontal
shoulder adduction with elbow flexion (while in a standing position) and needs an additional challenge, the therapist could lengthen the level arm by instructing the patient to perform the same shoulder movement with the elbow extended. Other examples of strengthening progressions include using or moving the arms in positions or directions to resist lower extremity movement (add drag) as well as simply using equipment to increase resistance (such as downward movement with a buoyant device or by using wrist and/or ankle weights). Finally, the therapist can progress a strengthening activity by adding directional changes (effecting inertia).

**Progresions for Balance**
In addition to strengthening progressions, there are also ways to progress balance activities and weight bearing. To progress balance activities, the therapist can instruct the patient to narrow his or her base of support. An example of a balance progression might be: wide base of support, feet together, one foot directly in front of the other, unilateral stance.

Another way to progress balance activities is to increase the water depth for the balance activity. Also, the therapist can add water turbulence. To progress or increase weight bearing (when cleared by the physician), the therapist can have the patient gradually perform functional activities at a decreased depth.

**Cool Down**
- Allow time for heart rate and respiration to return to normal
- Patient should relax prior to exiting the pool

**General precautions**
- Avoid overexertion and fatigue, pace the patient
- Avoid extreme ranges of motion that may cause pain
- If a movement hurts, modify activity by reducing the joint range of motion and/or decreasing resistance
- Use AFO as needed
- Weight bearing limitations (if appropriate)

**Considerations by Diagnosis**

**Considerations when working with the elderly**
- Minimize the use of gripping equipment due to the increased likelihood of the patient having arthritis and/or hypertension.
- Incorporate touch and socialization when possible. The treatment session may be the only time in the day where the patient has opportunities for touch and socialization.
- Encourage fluid intake.
- Encourage or require shoe wear for foot protection and safety.
- Consider activities that focus on fall prevention, balance/coordination activities, and functional motor activities such as scooping and reaching.
- Consider BackHab and/or Bad Ragaz.

**Diabetes**
- Require water shoes for skin protection.
- Encourage lower extremity exercises for circulation. Consider closed chain LE activities with visual observation for feedback. Also consider using more shallow water if working on proprioception.
- Know hyperglycemia and hypoglycemia signs and have a plan of action. Have patient check blood glucose levels prior to the therapy and 4 hours after exercise to monitor their response.
- Avoid overheating and encourage fluid intake.
Patients with Obesity

- Due to buoyancy, these patients are at an increased risk of tipping and losing their upright posture when doing aquatic activities. It is important to teach these patients and have them practice moving from a supine and prone floatation position to an upright position.
- Watch for overheating with this population since it takes them more energy to move. It is recommended the not participate in BackHab if the temperature is over 86 degrees and the lower extremity section of Ai Chi be skipped (since it requires the highest energy cost) if the patient looks tired.
- Be flexible with patient swimwear such as allowing a T-shirt to be worn and tucked into the patient’s shorts.
- Have the patient go deep enough in the water to offload joints to a comfortable level.
- Be aware of mass restrictions with exercise movement requests to prevent muscle substitution. For example, “bend your elbow” may be better than “touch your hand to your shoulder”.
- Recommend a skin barrier cream if needed.
- Watch for apnea and dyspnea and let the patient set his or her own breathing pace.
- Consider using a long duration period at a low intensity level. (Aquatic therapy may be one of the few times in the day when calorie consumption does not occur.)
- Consider using BackHab and/or Ai Chi.

Patients with CVA

- Every patient will require an individual exercise program to address particular needs
- Include rotational activities/exercises with and without equipment, to improve flexibility and decrease abnormal muscle tone
- Include repetitive activity, gradually increasing difficulty by increasing resistance, decreasing water support, etc. This may include but not be limited to walking forward, backwards, sideways (with and without equipment), dance routines and bicycling in sitting, standing positions
- Engage patients in higher level of activities, exercises, secondary to buoyancy support of water
- If CVA was hemorrhagic, it is recommended that aquatic therapy is avoided until at least 3 weeks post cessation of bleeding
- Avoid over exertion, pace the patient
- If facial weakness or dysphagia exists, avoid submerging face and avoid activities in which water can enter mouth or nose
- Modify or discontinue activity should tone change to the point motor control is affected using poor quality of movement
- Monitor patient’s affected hemibody and address activities accordingly
- If poor motor control exits in ankle/foot, utilize an AFO with socks/deck sneakers to protect ankle during dynamic upright activities
- Monitor skills if patient has impaired sensation

Patients with Parkinsons

- Every patient will require an individual exercise program to address particular needs
- Include several rotational activities/exercises, with and without equipment, to improve flexibility and decrease rigidity
- Choose appropriate activities to provide a conditioning component to treatment plan based upon individual needs
- Include repetitive activity, generally increasing difficulty by increasing resistance or decreasing support of water
- Avoid extreme ranges of motion which cause increased pain. If a particular movement hurts, modify activity by reducing the joint range of motion and/or decreasing resistance
- Avoid over exertion. Exercise to patient’s tolerance.
- Use caution in water as bradykinetic problems can cause sudden sinking
Patients with Multiple Sclerosis

- Every patient will require an individual exercise program to address particular needs
- Include several rotational activities/exercises, with and without equipment, to improve flexibility and decrease spasticity
- Choose appropriate activities to provide a conditioning component to treatment plan based upon individual needs
- Include repetitive activity, generally increasing difficulty by increasing resistance or decreasing support of water
- The buoyancy support of water will allow increased time for equilibrium reactions to occur. The resistance of water allows for more controlled movements. Note you may need to use AFOs, socks, shoes for joint protection.
- Avoid higher water temperatures (recommended temperature 84-88 degrees)
- Monitor skin due to decreased sensation
- Avoid over fatigue
- Avoid extreme ranges of movement that cause increased pain
- Monitor status with neutral warmth of water. Some patients will not tolerate even this temperature.
- If patient presents with poor ankle/foot motor control, use AFO with socks and/or deck sneakers to protect ankle joint when performing dynamic upright activities

Patients with Total Knee Arthroplasty

- Avoid excessive internal/external rotation of hip or tibial rotation of involved extremity
- Incision line must be intact, staples/steri-strip removed, with no presence of infection
- Weight bearing limitations (if appropriate)

Patients with Femur Fracture with Open Reduction Internal Fixation

- Avoid excessive ranges of hip adduction, internal and external rotation
- Incision line must be intact, staples/steri-strip removed, with no presence of infection

Patients with Total Hip Arthroplasty

- As on land, avoid hip flexion greater than 90 degrees, adduction and internal rotation
- Incision line must be intact, staples/steri-strip removed, with no presence of infection
- Weight bearing limitations (if appropriate)

Treatment Activities by Pool Level

On Ramp

- Crawling entry/exit (e.g. children pretending to be different kinds of animals)
- Crab-walk entry/exit
- Seated hip hiking (e.g. scooting up and down ramp on gluteals)
- Searching for underwater items on hands and knees
- Wheelchair mobility (up and down ramp)

On Steps

- Crab-walk entry/exit
- Seated hip hiking (e.g. lifting up and lowering down steps using triceps, latissimus dorsi, etc.)
- Seated stretches of lower extremities on lowest step (shallow enough for head-out immersion, but deep enough for body part to be unloaded)
- Seated exercises that encourage crossing of midline, use of neglected side, etc.
- Any exercise that is too difficult to perform seated in deeper water (e.g. child's play)
2' — 2'6" Depth (Approximate)
- Quadruped exercises (e.g., single arm raises, single leg raises, opposite arm/leg raises, abdominal crunches by bringing both knees to chest)
- Tall kneel exercises — single knee (e.g., initiation of standing from tall kneel, weight shift in the AP plane, maintaining positioning against outside turbulence)
- Tall kneel exercises — bilateral knees
- Plantar grade exercises (arms weight bearing on bottom of pool, legs floating)
- Transitional exercise (e.g., moving from quadruped to tall kneel, moving from tall kneel with a single knee to both knees, moving from quadruped to plantar grade) Inverted quadruped exercises ("Inverted" position)
- Floating (for fearful or small clients)

2'6" — 3'6" Depth (Approximate)
- Squatwalking
- Resisted walking and running (e.g., charging rapidly across the width of the pool)
- Resisted calisthenics (e.g., jumping jacks, cross-country skiing)
- Side saddle position in Watsu® (back to wall, squatted with leg in a Figure-4 position to hold client in "saddle"
- Calf strengthening and stretching (e.g., toe and heel rocking, heel cord stretch)
- Prone exercises with mask and snorkel (e.g., cervical, spinal, shoulder, and hip ROM, resisted PNF patterns)
- Bad Ragaz Ring Method (depth varies as provider is immersed to ~ T11 while standing)
- Some Task-Type Training Approach work simulation activities

3'6" — 4'2" Depth (Approximate)
This is the "critical working depth" for most patients and providers. If your pool doesn't have this depth -- and a lot of it -- you're in trouble.
- Reduced weight-bearing walking and running
- Reduced weight-bearing calisthenics Reduced weight-bearing spinal and lower extremity stretches
- Upper extremity PNF (proprioceptive neuromuscular facilitation)/ PRE (progressive resistive exercise) patterns
- Lower extremity PNF/PRE patterns
- Watsu sessions
- Wassertanzen sessions
- Halliwick games and instruction
- Ai Chi patterns
- Aquatic Feldenkrais® patterns
- Bad Ragaz Ring Method (depth varies as provider is immersed to ~ T11 while standing)
- Swim stroke training and modification (if instructor is standing in water)
- Manual therapy and massage
- Relaxation training and imagery
- Some Task-Type Training Approach work simulation activities

5'6" Depth & Deeper (Approximate)
- Unloaded distraction of spine and lower extremities
- Unloaded aerobic exercise Unloaded relaxation and imagery (including "hanging")
- Swim stroke training and modification (if instructor is standing on deck)
- Treading water and diving
Alternative Treatment Approaches

BackHab

BackHab is a program that was originally created for patients with mechanical back pain resulting from muscular imbalance. The program is found to be beneficial and functional for a wide variety of special populations such as patients with orthopedic and chronic conditions. Progressions for orthopedic and chronic conditions have been added to a variety of walking strides in the program and the use of deep-water exercises has decreased.

BackHab is an integrated program that focuses on alignment and utilizes water walking exercises using a variety of strides and techniques to help stabilize the core muscles while strengthening and coordinating the extremities. BackHab incorporates a variety of basic aquatic exercises while providing opportunities for postural alignment, proximal stability, strengthening, stretching, balance, coordination, endurance, and mobility in a functional way. Core stability can be further incorporated into the BackHab program by focusing on alignment, proximal stability, and proper recruitment. The therapist can provide tactile and verbal cues along with the exercises to assist the patient with skeletal alignment, core stability, and muscle firing patterns. BackHab provides a low impact exercise with resistance in all directions. It can be used for a variety of skill levels and can be done one-on-one or in groups. BackHab is a program that patients can continue on their own when they are no longer receiving therapy services.

Ai Chi

The Ai Chi program is based on Eastern thought including the mind/body or bodymind experience. Ai Chi is an aquatic exercise and relaxation program. More specifically, Ai Chi is a combination of deep breathing and slow broad movements of the arms, legs, and torso in flowing continual patterns. It combines the concepts of T’ai Chi, Shiatsu, and Qigong with basic movement patterns that can be done one-on-one or in groups.

Ai Chi includes concepts of slowness, flow, continuity, roundness, unification with the water, repetition, correct alignment and pelvic mechanics. Equal speed and force are applied throughout the movements and the progressions. There is no start or stop between the movements. The movements should be comfortable. The body (and its muscles) should feel some effort, but it should not feel pain. The arms should not go in and out of the water but should remain submerged in the water during the movements.

Bad Ragaz

Bad Ragaz is commonly used for tone inhibition, muscle relaxation, shortened muscle elongation, and progressive muscle strengthening. It is often known today as the Bad Ragaz Ring Method. Bad Ragaz is considered an aquatic muscle re-education technique. It is similar to PNF and utilizes floatation equipment to support the patient. The therapist must interact one-on-one with the patient. The concepts of Bad Ragaz include relaxation, tone inhibition, ROM, elongation, resistance and endurance.

Halliwick

This is a 10-step process that involves utilizing and analyzing developmental sequences of movement in water. Patients benefitting from this approach include those with balance deficits, motor control problems, hypertonicity and Hypotonicity, postural instability or fear of water. It is based on a disengagement principle where therapist guides patient through an activity and then gradually reduces assistance until the patient performs activity independently and then makes the activity more difficult by creating turbulent forces around patient. Some guidelines for progressions include:

- Utilizing vertical positions (standing or sitting) before horizontal positions (prone or supine)
- Alter amount of support (assistance provided by therapist or environment)
- Changing the base of support (center of gravity and buoyancy depending on depth of immersion and position)
- Adjusting to the effects of buoyancy
- Passive movement to more active movement
- Use of resistance including speed of movement
- Gradually increasing complexity of task
- Emphasize trunk control prior to focusing on extremity control
NDT Technique
This technique aims to inhibit abnormal tone, postures and patterns and to promote normal movement patterns. The decreased effort required in water yields more normal motor output which can help to establish normal feedback loops, even though working in water is not a gravity environment. With decreased spasticity secondary to the effect of warm water environment and the decreased effort of movement in the pool, more normal patterns can be experienced first with buoyancy assistance, then gradually graded up to gravity positions.

Grading activity in NDT includes:
- Amount of support (assistance provided by the therapist)
- Speed of movement (slow, transitioning to fast)
- Proximal manual contacts (key points) to more distal facilitory input
- Changing base of support (position in relation to gravity)
- Movement from one base of support to another
- Number of demands while performing a task
- Start patient with lower trunk-initiated movements then progressing to upper extremity and righting reactions

Watsu
Utilizes principles of Zen Shiatsu into the water combining the manipulation of the body’s meridians (pathways of energy). In Watsu, emphasis is placed on stretching the meridian which is similar to the points used in acupuncture. Using specific stretching techniques, this facilitates surfacing of stored energy where it can be released. The warm supportive water provides a free-flowing environment for this type of therapy. The free-flowing nature of Watsu promotes self-awareness of muscle tension and allows release of that tension, often decreasing pain, and increasing range of motion. The patient is a passive recipient and experiences a profound relaxation from the warm water support and continual, rhythmic movement, flowing from one position to the next. A specific sequence and transition of movements is completed by the therapist stabilizing or moving one segment of the body through the water, resulting in a ‘drag’ effect, stretching another segment. The patient can often tolerate extensive stretching and soft tissue manipulation in the warm supportive water environment that they cannot tolerate on land. Contraindications to Watsu include ROM precautions, acute ligamentous instabilities, recent spinal surgery, recent bone fractures, arthritic cervical spine, frequent ear infections, excessive vertigo, dizziness or vestibular disorders.

Watsu sequence:
- 21 movement steps in the first sequence (takes approximately 1 hour to complete)
- First 5 basic moves (Watsu transition flow)
  - Water Breath Dance – begin from wall. Stay low in the water, feet spread, the neck of the patient in the crook of your left elbow, our right arm under the sacrum, the patient’s right arm behind your back, slowly sink and rise with your own breath.
  - Open arms – slide your right forearm under the knees, balancing the patient between your arms, continue to sink and rise.
  - Accordion – sink the patient deeper, gradually bringing knees close to the chest on each out breath. Open arms on in breath.
  - Rotating accordion – rotate both legs, bringing the knees close to the far shoulder on out breath
  - Near leg rotation – rotating both legs, let the far leg slip off your forearm, rotate near leg

Task-Type Training Approach
This is a task-oriented approach with emphasis on influencing the patient’s disability by working in functional positions with functional activities. The patients are more active participants in problem solving their movements rather than passive recipients of manual or verbally cued input from therapists. This is a set of principles, rather than a specific treatment technique which assists the therapist to design a treatment phase to individually meet the patient’s needs. Benefits include promoting higher independence and problem-solving skills, providing gradual, progressive guidelines for all functional activities improved postural stability and quality of movement.
General principles of TTTA:
- Work in shallowest water tolerated
- Practice functional activities as a whole
- Systematically remove external stabilization provided for patients
- Encourage stabilizing contractions in upright positions with movement of selected body segments
- Encourage quick, reciprocal movement
- Encourage active movement problem solving

Ai Chi Ne
- Partner stretching program
- Involves breathing techniques to increase relaxation and therefore enhance the stretch abilities
- Using the breathing techniques decreases stress, joint tension, muscular tension and the stretch reflex response

Burdenko Method
- Used for athletic training and as a therapeutic method for people with disabilities
- Concepts include integrating land and water therapy, using a vertical position, focusing on the whole body and homework

Feldenkrais
- Uses gentle movement and directed attention to improve movement
- Aims to increase ease and range of motion, improve flexibility and coordination to enhance function

Lyu Ki Dou
Lyu Ki Dou emphasizes the facilitator's self-care, which in turn will benefit the clients/patients that are receiving any type of therapy or exercise programming

Massage
Use of soft tissue manipulation and body mobilization techniques in water warmer than skin temperature (92º F - 93º F)

Water Pilates
- Pilates exercises have been adapted for the pool
- Designed to improve strength, flexibility, and range of motion and also encourages musculoskeletal alignment
- The main tenets are resisting your own weight, controlled breathing, spine alignment and abdominal strengthening.

Unpredictable Command Technique (UCT)
- Goal of progressing the client so that two or more motor movements are done simultaneously
- Improved somatic awareness and motor control can be achieved through the challenge to do a variety of constantly changing familiar and unfamiliar activities
- Benefits include improved voluntary control and awareness of movement and body in space

Wassertanzen
- Dynamic movement therapy that includes work below the water surface with the aid of nose clips
- Challenges a person to surrender control of his breath to go underwater.

Water Yoga
- Hatha yoga poses performed in warm, waist- to chest-depth water develop strength and static balance simultaneously
- ROM increases in coordination with diaphragmatic breathing and long exhalations
Yogalates

- Combines Yoga, Pilates, and Ai Chi
- Static poses and core stabilization exercises are transitioned with circular movements and emphasis on deep breathing to create a continual fluid program
- The objectives are increased body awareness, strength, range of motion and relaxation
The water provides an excellent environment for individuals with disabilities to improve physical fitness for two reasons. First, the physiological effects that occur when one is just submerged in the water are often beneficial to those with disabilities. For example, the warmth and pressure of the water on the body increases circulation, aids in relaxation, and promotes deeper breathing. Second, the density of the water requires more effort to move through it than air. This may facilitate movements that are often difficult to perform on land. For instance, the water resistance increases the workload on the body making dynamic movement much more challenging. In addition, the decreased gravitational pull and buoyancy cushions joints and reduces impact which makes movement less painful. The extra support the water provides allows for greater freedom of movement.

Station/Activity #1
Stair Stepping/Ladder Climbing
Using pool stairs or ladder walk/climb to top and walk/climb back down. If using ladder, individual may get out, jump/sit in off edge to allow several students to use the stairs.
Equipment-Pool stairs/ladder
Training Benefits-balance, lower body strength and endurance, coordination, (upper body strength if using ladder)

Station/Activity #2
Cone Obstacle Course
Place markers on bottom of the pool for form pattern. Participants move throughout course using a variety of locomotor movements.
Equipment-heavy plastic cones or markers, sand filled jugs
Training Benefits-balance, agility, gait training, cardiorespiratory endurance

Station/Activity #3
Balance Beams
Using lines on the bottom of the pool walk balance while walking across.
Equipment-none
Training Benefits-balance, gait training

Station/Activity #4
Pole Challenges
Place a pole at an angle so students can choose to step over it at low, medium, or high levels. They can also move in different directions over it, jump over it, or swim under it.
Equipment-pool extension pole anchored to the pool wall and weighted down in the water provides a sloping angle.
Training Benefit-lower body strength and endurance, gait training, agility, coordination, breath control, (cardiorespiratory endurance if continuous)

Station/Activity #5
Hula Hoop Challenge
Lift hoop up overhead using one or two hands...bring down to feet and step out of the hoop. Repeat and/or go from feet to head.
Equipment-hula hoops
Training Benefits-upper body flexibility, balance, coordination
Station/Activity #6
Water Chair Challenges
While sitting and holding onto chair kick legs using scissors (up, down), straddles (in, out), or knee bends (bend, straighten). Legs can be moved together or one at a time, to increase resistance add flippers or flotation devices (water wings).
Equipment-chairs that sink or are weighted down
Training Benefits-trunk, abdominal, and lower extremity strength and endurance, cardiorespiratory endurance, flexibility

Station/Activity #7
Water Jugs/Buckets
Using laundry jugs and buckets, students pour and fill jugs in an area of the pool where they can sit and stand.
Equipment-laundry jugs and buckets
Training Benefits-upper body strength and endurance, eye-hand coordination

Station/Activity #8
Monkey Walks
Using sliding or overhand technique, participants monkey walks along the pool gutter.
Equipment-pool gutter that is water level or just a little above
Training Benefits-upper body strength and endurance

Station/Activity #9
Sponge/Toy Challenge
Float sponges/toys in water, on signal students pick up one sponge/toy and place it in designated bucket, repeat. Vary locomotor movements. Focus on competition with self, not others.
Equipment-sponges/toys and containers to put them in
Training Benefits-cardiorespiratory endurance, balance, coordination, eye-hand coordination

Station/Activity #10
Noodle Tag
Using swim noodles as taggers, participants avoid being tagged while staying in designated area. If tagged, must do 3 bobs or bubbles and back in the game.
Equipment-swim noodles
Training Benefits-cardiorespiratory endurance, breath control, balance, coordination

Station/Activity #11
Keep It Up
Individuals/partners/small groups try to keep balloon from touching the water.
Equipment-balloons
Training Benefits-upper body strength and endurance, eye-hand coordination

Station/Activity #12
Push Downs
While standing on bottom, push a ball, kickboard or other floating object down under water and slowly bring back to surface. Repeat. (Be sure to use soft objects in case it gets out of control and comes to the surface quickly.)
Equipment-balls, kickboards or other soft floating objects
Training Benefits-upper body strength
Station/Activity #13
Horses
Using swim noodle as a horse/pony try to balance as long as possible w/o feet touching bottom, challenge others or go for individual high score counting 1, 2, 3....
Equipment-swim noodles
Training Benefits-balance, abdominal/trunk strength and endurance

Station/Activity #14
Water writing
While standing or sitting and wearing swim paddles on hands write letters, shapes, words, numbers w/ hand under the water, be sure to practice with both hands.
Equipment-swim paddles
Training Benefits-upper body strength and endurance, flexibility

Station/Activity #15
Whirlpool
In small group walk in circle creating current, then quickly reverse direction and walk against the current.
Equipment-none
Training Benefits-lower body and trunk strength, balance

Station/Activity #16
Mat Challenges
While team supports mat one student tries to crawl or roll across, sit, kneel or stand on mat.
Equipment-gymnastics mat that is free of holes in the outer covering
Training Benefits-balance

Station/Activity #17
Wall Push Ups
Using arms only, lift body up out of water at wall and lower slowly and carefully back into the water. Repeat. Care should be taken not to lift past point of comfort because the reentry into water must be slow or injury to chin could result.
Equipment-none
Training Benefits-upper body strength and endurance

Station/Activity #18
Sharks and Minnows
Shark is the tagger in middle of designated space, on command minnows try to cross "shark tank" w/o getting caught. If caught minnow becomes a shark helper and is able to tag others. Participants can cross "shark tank" using a variety of locomotor and swimming movements.
Equipment-none
Training Benefits-cardiorespiratory endurance, balance, coordination

Station/Activity #19
Giant Kickboard
Using the mat as a big kickboard the entire group hangs on with hands and moves it across pool using the kick of choice.
Equipment-gymnastics that is free of holes in outer covering
Training Benefits-cardiorespiratory endurance
Station/Activity #20
Submarines
Swim through hula hoops anchored to bottom or closer to water surface
Equipment-hula hoops
Training Benefits-cardiorespiratory endurance, breath control

Station/Activity #21
Poison
Place floating objects in designated area, students must move around using a variety of locomotor or swimming skills w/o touching the "poison," change skills to target fitness areas.
Equipment-floating toys or objects
Training Benefits-cardiorespiratory endurance, lower body strength and endurance, balance

Some considerations/recommendations when planning physical fitness stations/activities:

Cerebral Palsy
- Water temperature of 85-95 degrees is ideal for those with contractures. Air temperature should be 10 degrees higher.
- Provide "calm/relaxing" environment.
- Encourage normal postural.
- Preferred strokes are those in supine position such as the elementary backstroke. Strokes/skills that are performed the same bilaterally (homologous) are best.
- Maintain the head in a neutral position and avoid extension because extending the head will increase extensor tone and eliminate the possibility of relaxation.
- Swimming in the prone position should be avoided until individual feels comfortable with face in the water because swimming with the head out of the water will increase extensor tone throughout the back and prevent relaxation.
- The flutter kick is contraindicated because it increases muscle tonus.

Spinal Cord Injuries/Paraplegia
- Any stroke can be successfully learned.
- Placing floats around the knees can reduce the "drag" effect caused by nonfunctional lower extremities and allow the swimmer to move in a more streamlined position.
- Regular socks or Aqua socks are recommended to prevent possible scrapes /scratches to feet from pool bottom, sides and steps.

Spinal Cord Injuries/Quadriplegia
- Accommodate and encourage as much movement as possible.
- Use flotation devices that support yet allow maximum levels movement of the extremities.
- Homologous strokes such as the elementary backstroke provide the best method of movement.
- Supine strokes are recommended because breathing is sometimes a problem.
- Provide short periods of intense work with longer periods of rest.

Muscular Dystrophy
- Use moderate levels of activity and do not over fatigue. Build in frequent rest periods.
- Water temperature should be 85-95 degrees.
- Make sure the individual does not get "chilled" because they are very susceptible to pulmonary infections. Once finished dry him/her off quickly in warm air and put on warm clothing.
- The elementary backstroke w/ flutter kick is most preferred.
- The objective of swimming is to maintain strength to prolong independent movement skills.
Scoliosis or Kyphosis
Because the goal is to stretch and strengthen upper back/shoulder muscles the back crawl, elementary backstroke and breaststroke are most recommended.

Lordosis
- Because the goal is to stretch the hip flexors and lumbar extensors the scissors kick on both sides is recommended.
- Diving is contraindicated because of the high impact it has on the spine.

Amputee
- Partial amputees should use affected limbs as much as possible.
- Watch for initial balance problems due to the effects of water buoyancy.
- Upper extremity/complete bilateral focus on kick, scissors or whip.
- Upper extremity/complete unilateral-side stroke recommended w/ nonfunctional arm down.
- Lower extremity/complete bilateral focus on arm action and glide portions of strokes.
- Lower extremity/complete unilateral-requires stronger pull w/ opposite arm, flutter kick will assist with directional control.

Visual Impairments
- Use sighted guides or electronic auditory cueing aides.
- Allow individual to "survey" the entire aquatic environment including locker room, pool deck, and pool to assure familiarity with environment.
- Use large print station/activity cards.

Seizure Disorders
- All aquatic personnel should be notified prior to participant entering the pool.
- Do not over fatigue or over work.
- Diving is often contraindicated.
- Avoid deep-water swimming.
- Supervise closely after swim since seizures are likely to occur during "cool down."
- If seizure occurs in the water, maintain head above water and allow seizure to continue. It may be necessary to have 2 people support the individual’s body under water. After the seizure, allow participant to rest in a warm, dry area and provide proper emergency procedures.

Arthritis
- Work within limitations of range of motion.
- Avoid exercising to fatigue, provide frequent rest periods.
- Water temperature should be 85-95 degrees.

Down syndrome
- Consider developmental and motor delays when planning.
- Use short, simple statements to aide understanding, demonstrations.
- Vary activities.
- Autism
- Eliminate unnecessary external stimuli.
- Use short, simple statements, demonstrations and physical prompts.
- Use vigorous aerobic exercise to limit self-stimulatory and off task behaviors.

Asthma
- If attack occurs prior to swimming activity get medical clearance before individual enters water.
• If an attack occurs in the water, maintain an open airway and get participant out of the water.
• The sudden change in body temperature caused by contact with the water may trigger an attack but should not prohibit individuals from participating in aquatics.

Behavior Disorders
• The use of floatable objects will interest the participant.
• Because the individual may disregard safety practices, constant reinforcement of safety rules is necessary.
• Situations that might cause fear or stress should be avoided.

Spina Bifida
Since the goal is the prevention of contractures, stretching and strengthening aquatic activities such as floating and kicking are recommended.

Multiple Sclerosis
• Water temperature should be 80-84 degrees. Water that is too warm will increase circulation too much.
• Activity may be contraindicated at times; be careful to not to over fatigue. Provide rest periods.
• Sensory input may be slow; care should be taken to avoid abrasions.
• Focus on strengthening muscles around affected areas.
• Provide ambulation activities.
Common Equipment Used in Therapy

Examples of kickboard uses in aquatic therapy

- Buoyancy
  - Prone kicking
  - Seated balance/proximal stability
  - Placement under one or more forearms (for balance or gait training)

- Resistance/Strengthening
  - Chest press with the body stabilized (for upper extremity strengthening)
  - Forward ambulation with the kickboard held in front of the chest to increase drag

Examples of swim noodle uses in aquatic therapy

- Buoyancy
  - Under the arms for LE open chain exercises in the deep end
  - Seated straddle for dynamic stability
    - Closed chain similar to a swiss ball
    - Open chain with upper extremity activity or lower extremity
  - Bicycling/moving forward in the water
  - Side straddle for dynamic stability or lower extremity bicycling

- Resistance/Strengthening
  - Shoulder or hip adduction and UE press downs

- Stretching
  - Standing hamstring, hip adductor, quadriceps and hip flexor stretches while holding the rail or the pool’s edge

Examples of ankle/wrist weight uses in aquatic therapy

- Resistance/Strengthening
  - For a large variety of UE and LE movements in all planes

- Proprioceptive feedback
  - By increasing sensory input
  - Assisting flaccid extremities with weight bearing
  - For patients with CVA, TBI or cerebral palsy

- Spinal traction
  - When used in conjunction with a buoyant device in the deep end of the pool
BackHab

BackHab is a program that was originally created for patients with mechanical back pain resulting from muscular imbalance. The program is found to be beneficial and functional for a wide variety of special populations such as patients with orthopedic and chronic conditions. Progressions for orthopedic and chronic conditions have been added to a variety of walking strides in the program and the use of deep-water exercises has decreased.

BackHab is an integrated program that focuses on alignment and utilizes water walking exercises using a variety of strides and techniques to help stabilize the core muscles while strengthening and coordinating the extremities. BackHab incorporates a variety of basic aquatic exercises while providing opportunities for postural alignment, proximal stability, strengthening, stretching, balance, coordination, endurance, and mobility in a functional way. Core stability can be further incorporated into the BackHab program by focusing on alignment, proximal stability, and proper recruitment. The therapist can provide tactile and verbal cues along with the exercises to assist the patient with skeletal alignment, core stability, and muscle firing patterns. BackHab provides a low impact exercise with resistance in all directions. It can be used for a variety of skill levels and can be done one-on-one or in groups. BackHab is a program that patients can continue on their own when they are no longer receiving therapy services.

BackHab can benefit any ambulatory patient including those with orthopedic and/or musculoskeletal conditions, chronic conditions such as fibromyalgia, arthritis or MS and patients with CVA.

A pool depth between waist and chest height for ambulation activities is generally used. Patients should wear supportive, non-slip shoes and the pool should have a non-slick pool bottom. Equipment should be avoided in most cases, but there are a few exceptions. If floatation equipment is needed for walking balance, the patient should keep or hold it close to the body to prevent postural malalignment. When working with patients with neurological deficits, floatation devices or weights may be needed for safety or to help the patient relearn movement patterns. Buoyant equipment may also be used if the therapist wants the patient to participate in deep water activities as part of the program.

**BackHab Guidelines**

Focus on alignment and posture with the patient initially. The patient should wear aquatic shoes and begin with 10-15-minute exercise sessions (depending on patient history and evaluation findings) with the goal of increasing the session time 5 minutes a week (as long as pain is not exacerbated or resulting from the activities). After easing into the sessions, encourage at least 15 minutes (30 minutes is ideal) for the exercises at least 3 times a week if tolerated.

The treatment sessions should begin with a warmup period and alignment/posture work. The patient should focus on proper body alignment throughout the program. Core stability in the program can be emphasized by contracting the abdominals, depressing the scapulas and contracting the gluteal muscles during forward, backward and lateral ambulation.

The therapist should instruct the patient to begin with a conservative stride length and swing his or her arms naturally. (Later, the UEs can be used as a progression.) Walking exercises should be performed both forwards and backwards and sidestepping exercises should be performed to both the right and the left. Although both agonist and antagonist muscles will be stretched and strengthened, encourage strengthening of weak muscles and stretching of tight muscles to decrease muscle imbalance. It is recommended the exercises are repeated for 2-4 minutes (and stopping earlier if technique is poor).

The body and its muscles should feel some effort, but it should not feel pain. Have the patient stop exercises that cause pain and apply the two-hour rule. If there is more pain two hours after exercise, too much was probably done in the treatment session.
Posture work and warm up
Have the patient pretend a helium balloon is holding and lifting the head up. Instruct the patient to avoid cervical hyperextension. The chin is back, and the neck is long. From a sagittal view, the ears should be centered over the shoulders and the shoulders should be over the hips. The shoulders should drop away from the ears. The scapulas are lightly pressed down (toward the “pretend” hip pockets). The rib cage is slightly elevated. Allow the patient’s natural back curves to remain. Have the patient maintain a neutral pelvis. The abdominals are lightly in and up. Encourage the patient to imagine lifting the pelvic bone toward the naval without flattening the back. The gluts should be lightly squeezed.

Abdominal strengthening and back stretching
Abdominal strengthening and back stretching can be done after the warmup period, near the end of the treatment session, or much more frequently depending on the patient’s needs. This can include back stretches and piriformis stretches.

Aquatic ambulation (both forwards and backwards)
A large variety of optional strides can be used when moving forwards and backwards in the water. These include:

- Normal stride walk
- Walk and crunch
- Heel walk
- Toe walk
- Walk the line
- Crossing steps
- Marching
- Power walk

Moving sideways (lateral movement)
There are also optional strides that can be used when moving sideways including:

- General sidestepping
- Sidestep and crunch
- Sidestepping with dips/squats
- Crossover steps
- Grapevine steps

Progressions
The following are BackHab progression options for therapists to create a program to meet their patient’s needs. These progressions can be added to the forwards/backwards or sideways moving strides. The therapist may want the patient to return to basic aquatic ambulation (forwards and backwards with mental visualization of alignment/posture) after a progression or add on additional progressions to the exercise. Not all progressions will be appropriate for all patients. If a patient is unable to maintain the correct alignment after a progression has been added, return to previous level where proper alignment can be maintained.

Progressions can be combined or added on. For example, the therapist may ask the patient to use a marching stride while utilizing the heavy concept (1) and then have the patient decrease his speed (3). In addition, the therapist may ask the patient to take sidesteps with stops or pauses (2) and then ask her to place her hands behind her back during the activity (5).

- Heavy concept
- Add stops during the gait cycle
- Decrease the speed
- Lengthen the stride
• Vary the upper extremities
• Vary eye or head movements
• Increase water depth
• Add turbulence
• Increase force of movements

Cool down
• Instruct the patient to slow down the speed and intensity. Ambulate forward and backwards for several minutes. Continue to maintain good postural alignment but eliminate any forceful movements and/or movement progressions.
• Additional stretches that may be beneficial include those for the hamstrings, calves, quadriceps and hip flexors

Special Considerations

Arthritis
• Increased depth may need to be used so that affected joints are submerged
• Modifications may include the addition of fine motor ROM activities and functional UE movements
• Avoid any equipment that requires gripping
• All movements should be controlled focusing on the muscles working rather than hanging on the joints.

Asthma/COPD
• Begin in shallow water and watch for signs of distress when slowly progressing to an increased depth
• Increase the warmup period
• Encourage nasal inhalation so that the entering air is warm and lubricated
• Avoid eating 2 hours before therapy since combining food (which possibly can cause an allergic reaction for the patient) and the chlorine in the air can be problematic
• Encourage the patient to stay hydrated and have the inhaler at the pool’s edge
• Provide additional opportunities for rest breaks and relaxation time using diaphragmatic breathing

Low Back Pain
• Increase the warm-up period
• Encourage ambulation with correct alignment and utilize the heavy concept to improve core stability
• Deep water activities may be beneficial for offloading, but make sure that proper alignment is maintained since deeper water decreases stability

CVA
• Backward ambulation activities can be particularly helpful in this population
• Optimal water depth for the patient may depend on treatment goal (e.g., balance or LE weight bearing). If a lack of weight bearing on one side is the bigger concern, it may be beneficial to begin in deeper water (with more of the body weight offloaded) and progress to shallower water. If balance training is a priority, the patient can start in shallower water and progress to deeper water as the patient’s balance improves and needs challenging.
• Equipment may be needed to help anchor or stabilize a flaccid extremity
• Buoyant equipment may be needed to facilitate movement of a spastic extremity

Fibromyalgia
• Use increased depth to encourage relaxation and pain relief
• Avoid cold water and temperature extremes
• Encourage patients to work easily to avoid excessive and/or inappropriate muscle recruitment as well as fatigue
• Provide opportunities for relaxation at the end of the therapy session to encourage a parasympathetic response
• Diaphragmatic breathing may be beneficial
Hip Replacement
- Equipment can be used to assist with balance and posture
- The therapist needs to be aware of each patient’s specific contraindications and avoid or modify the activities that incorporate them

Knee Injury or Knee Replacement
- Torque at the joint and/or lower leg zig zagging when moving through the water should be avoided
- Keep the knee and the foot in the same longitudinal axis
- Encourage closed chain movements. When open chain movements are being used, have the patient decrease his or her speed.
- Don’t allow knee hyperextension during hip extension activities
- Water depth can be increased for the patient if weight bearing issues are present
- Avoid equipment unless it is necessary for balance or posture
BackHab Guidelines and Progressions

1. Normal stride walk
   Why?
   - To work on alignment
   - To work on coordination with a variety of progressions
   *Avoid leaning forward

2. Walk and crunch
   Have the patient practice contracting the abdominals on every nth step pretending that there is a sponge in the stomach that can be squeezed out (during exhalation). The patient can also pretend that on the nth step they are being lightly punched or hit in the stomach. A pinwheel can also be used to practice abdominal squeezing during exhalation.
   Why?
   To increase abdominal strength and deeper tissue awareness
   *Watch for hyperventilation and space the forced exhalations out. Also, avoid bending forward when focusing on squeezing during exhalation

3. Heel walk
   Why?
   - To work on balance and coordination
   - To work on muscular endurance of the anterior tibialis muscles
   - To work on gastrocnemius stretching
   *Avoid trunk/hip flexion and knee hyperextension

4. Toe walk
   Why?
   - To work on balance and coordination
   - To work on axial elongation
   - To work on gastrocnemius endurance
   *Avoid leaning forward

5. Walk the line (with normal stride length)
   Part 1 – Take steps as if walking on a line
   Why?
   - To challenge balance (narrowed base of support)
   - To work on coordination/motor planning
   - To increase gluteal firing
   *Avoid leaning forward or pronating the feet
   Part 2 – Add hip abduction to the line walking before stepping down
   Why?
   - To challenge balance (increase unilateral stance time)
   - To add hip abductor and adductor strengthening

6. Take Crossing steps
   Part 1- Have the patient cross each foot over the other when stepping forward or backwards. For example, with forward movement, step the left foot to the right side of the right foot before shifting weight onto it.
   Why?
   - To work on balance, coordination and motor planning
   - To work on strengthening the abdominal obliques
   - To work on strengthening the hip adductors
*Avoid shoulder rotation and supination of the feet. Check for hip precautions.*

Part 2 – Add ipsilateral hip abduction prior to crossing
(The patient will abduct the LE slightly before crossing and stepping.)

Why?
- To further challenge balance (increase unilateral stance time)
- To work on add hip abductor and adductor strengthening

*Avoid substituting hip abduction for hip external rotation with flexion. Avoid shoulder rotation and supination of the feet. Check for hip precautions*

7. High knee walking/marching (with slow controlled hip flexion)

Part 1 – Take steps in a typical high knee walking pattern

Why?
- To work on balance (increase unilateral stance time)
- To work on hamstring and gluteal strengthening (especially when pressing the feet posteriorly during backward stepping)

*Avoid leaning forward or laterally at the trunk. If knee lifts are asymmetrical, use the lower flexion so that both lifts are equal

Part 2 – Add “knee outs” -- (Forward movement would be “up, in, down” (where up = hip flexion in ER with knee flexion, in = hip IR, down = foot stepping down and anteriorly) and backward movement would be “up, out, down” where up = hip and knee flexion, out = hip ER, and down = taking a step posteriorly)

Why?
- To further challenge balance (increase unilateral stance time)
- To work on hip ROM
- To work on strengthening of the hip ER/IR muscles
- To work on coordination/motor planning

* Check for hip precautions

8. Power walk (forward lunge then feet together)

Why?
- To work on strengthening the gluts, quads, and hamstrings
- To work on LE ROM

*Avoid forward leaning

Moving sideways (lateral movement)

1. General sidestepping

This is done moving to the right and the left taking at least 8 steps to each side while focusing on alignment. The toes should face forward and the patient should avoid truncal leaning. One LE should step out to the side and the other should adduct to the weight bearing LE (for closed upright stance).

Why?
- To work on hip adductor/abductor strengthening for hip stability
- To work on coordination
- To work on balance

2. Sidestep and crunch

During sidestepping, have the patient practice contracting the abdominals on every nth step, like the “walk and crunch”, pretending that there is a sponge in the stomach that can be squeezed out (during exhalation). Space these exhalations out like the “walk and “crunch” exercise described in the aquatic ambulation section above.

Why?
- To increase abdominal strength and deeper tissue awareness
*Watch for hyperventilation and space out these stronger exhalations. Also, avoid bending forward (when focusing on squeezing during exhalation)

3. Sidestepping with dips/squats
The therapist may ask the patient to perform the squats during the hip abduction or adduction phase. It can be done with or without additional gluteal squeezing, while going into or coming out of the squat.

Why?
- To work on strengthening the quadriceps, hamstrings, and gluteal muscles
- To work on stoop and recover skills and sit ↔ stand transfers

* Maintain a straight spine when squatting and make sure that the knee is directly above the ankle

4. Take crossover steps
Instruct the patient to cross the left foot over the right when moving to right and cross the right foot over the left when moving to the left.

Why?
- To work on strengthening the abdominal obliques
- To work on balance
- To work on coordination/motor planning
- To work on bilateral integration (weight shifting while crossing midline)
- To work on hip flexibility/ROM

* Avoid twisting the shoulders or the hips. Avoid using different stride lengths. (Use the shorter stride length for both LEs.) Avoid supination/pronation of feet when landing.
* Check for hip precautions

5. Take grapevine steps

Why?
- To work on pelvic and trunk stability
- To work on balance
- To work on coordination/motor planning
- To work on bilateral LE integration

* Avoid twisting the shoulders or the hips. Avoid using different stride lengths. Use the shorter stride length for both LEs. Avoid supination/pronation of feet when landing.
* Check for hip precautions

What are the progressions?

1. Utilize the “heavy concept”
Instruct the patient to conceptualize that the extremity is heavy before moving it, pretending that a TheraBand or the therapist is resisting the movement.

Why?
- To increase abdominal firing
- To change muscle recruitment, with trunk muscles contracting first (repatterning: proximal to distal)
- To increase energy cost

* Caution for patients with HTN

2. Add pauses or stops during the gait cycle.
This can be done in positions that are more or less stable (such as during unilateral stance with forward ambulation or when the feet are together after adduction during sidestepping).

Why?
- To work on balance (and provide opportunities for a decreased base of support)
- To work on trunk stabilization
- To increase the energy cost
3. Decrease the speed
Instruct the patient to slow the movement down without changing the stride.
Why?
- To work on proprioception and neuromuscular retraining
- To work on balance (increase unilateral stance time)
- To work on trunk stabilization

4. Lengthen the stride
Why?
It may decrease stride width (during forward/backward ambulation)
- To provide an iliopsoas stretch (during forward/backward ambulation)
- To work on gluteal strengthening (when moving backwards)
- To work on hip ROM
*Avoid forward leaning and excessive hip flexion as well as “slamming” the foot down when moving forward

5. Vary the UEs
This can include movements that are unilateral or bilateral. Bilateral movements can be either symmetrical or reciprocal. In addition to adding arm movements, the therapist can also have the patient eliminate UE movements all together.
Why?
- To resist the LE movements and increase the energy cost. For example, the UEs could be placed in partial abduction to increase drag with forward or backward movement. Also, the UEs could move in the same direction of the LEs (such as butterfly arms with backward ambulation).
- To challenge balance. For example, the UEs could be not used at all and placed behind the back during forward/backward movement or on the thighs during lateral movement.
- To work on coordination

6. Vary the eye or head movements
Examples include closing the eyes or rotating the head to one side.
Why?
- To work on proprioception and balance
- To slow the stride
*Be careful with eye closing (particularly in a group setting)

7. Increase water depth
Why?
- To challenge trunk stabilization
- To increase the energy cost
*This may not be an option (and may even be a contraindication) for patients with COPD, fear, or possibly obesity. In addition, be vigilant about the patient maintaining good posture with this progression.

8. Add turbulence (such as creating it with a kickboard or using line formations or group circles) to any of the aforementioned progressions.
Why?
- To work on balance
- To work on trunk stabilization
9. Increase the force of movements

Why?
- To work on strengthening
- To increase the energy cost

Cool down

1. Hamstrings
   - Using a noodle or buoyant cuff at the ankle, allow the lower extremity to float horizontally at a right angle to the trunk (with the side or the back to the wall).
   - Bring one knee toward the chest and straighten the knee until easy tension is felt. Manually hold the position (with the back to the wall).
   - Bring one knee toward the chest and place the foot balancing on the pool wall or pool edge (while facing the pool wall).
*Avoid leaning forward with the hamstring stretches

2. Calves
   - While facing and holding the pools edge, step back with one LE (hip hyperextension) and lean slightly forward bending the anterior knee without raising the posterior heel. The forward LE is in hip and knee flexion.
   - Begin by standing on a step in a stable position with UE support; slowly lower one or both of the heels.

3. Quadriceps
   - Flex the knee and bring one heel toward the ipsilateral buttocks (facing and possibly holding the pool wall).
     Manually hold the position.
   - Flex the knee and bring one heel toward the ipsilateral buttocks (facing and holding the pool wall) with a noodle or floatation cuff under the dorsal aspect of the ankle to maintain the position.

4. Hip flexors
   - Flex the knee and bring one heel toward the ipsilateral buttocks (facing and possibly holding the pool wall) while holding onto the pool’s edge with the other hand. Allow the knee to move posteriorly and perform a posterior pelvic tilt. Manually hold the position.
   - Using a stair and a noodle, place the anterior foot onto a step. Position a noodle on the contralateral ankle with the knee flexed. Allow a passive stretch into hip extension provided by the buoyant device.
The Ai Chi program is based on Eastern thought including the mind/body or bodymind experience. Ai Chi is an aquatic exercise and relaxation program. More specifically, Ai Chi is a combination of deep breathing and slow broad movements of the arms, legs, and torso in flowing continual patterns. It combines the concepts of T’ai Chi, Shiatsu, and Qigong with basic movement patterns that can be done one-on-one or in groups.

Ai Chi includes concepts of slowness, flow, continuity, roundness, unification with the water, repetition, correct alignment and pelvic mechanics. Equal speed and force are applied throughout the movements and the progressions. There is no start or stop between the movements. The movements should be comfortable. The body (and its muscles) should feel some effort, but it should not feel pain. The arms should not go in and out of the water but should remain submerged in the water during the movements.

Patients benefiting from Ai Chi include those with orthopedic or musculoskeletal problems (low back pain, repetitive stress injuries, balance deficits, sports injuries), chronic disorders (chronic pain, fibromyalgia, arthritis, cancer, multiple sclerosis, cerebral palsy), neurological deficits (CVAs and TBIs), cardiovascular and circulation disorders, metabolic disorders, respiratory disorders and patients with post-mastectomy needs.

Guidelines
The water needs to be deep enough for the patient to work comfortably at neck level with some knee bend. The shoulders and arms remain submerged in the water during the activities. Ai Chi can be done in water temperature ranging from 86-95 degrees F, however, it is important to remember that the water temperature must be warm enough to allow the patient to relax. No equipment is needed for Ai Chi and the 2-hour pain rule applies for patients.

Ai Chi moves through a progression of movements. These movements are sometimes referred to as exercises, poses or postures. The ending position of the completed movement is the starting position of the subsequent movement. Ai Chi begins with deep breathing and then adds: upper extremity (UE) movements, trunk stability movements, lower extremity (LE) movements and total coordinated body movements.

Not all movements or progressions should be used or performed during the patient’s first Ai Chi session, even if working with a healthy client. In fact, the first session may focus on deep breathing and then add a few of the UE movements. Early treatment sessions should have increased repetitions to focus on breathing, alignment and movement mastery. These early sessions should be shorter in duration as well. Progressions should be taken slowly. The patients should work on mastering early movements before progressing to those which are more advanced. ROM can be decreased if needed for balance. More relaxation is gained once the program becomes more familiar. Less thought will be placed on the movements and more will be placed on the breathing. Increased repetitions lead to stability and confidence and confidence leads to increased relaxation. Music and directional cuing can be helpful to the patient. Music is often used to increase relaxed awareness. The chosen music should be relaxing. Specific Ai Chi music is even available. Directional cuing such as “open behind” and “close left” can assist the patient in learning the movements.

Postures
Contemplating -- Slow diaphragmatic breathing
In the initial position, the patient’s feet are placed at least at shoulder width apart with the knees and toes pointed slightly outward. The knees and toes should remain in the same longitudinal axis to each other throughout the program. The knees are bent and should remain soft. The pelvis and spine should be in a neutral position. From a sagittal plane, the shoulders should be directly over the hips. The shoulders should drop away from the ears and the UEs are supported by the water close to the surface with the forearms pronated and the thumbs touching each other. The cervical spine should be in neutral alignment. The therapist can have the patient think of the head being suspended from above. The chin should be in a relaxed position and pointed slightly down.
Using diaphragmatic breathing, the floor of the diaphragm moves downward pushing the abdominal organs down and forward during the inhalation phase. The abdominal muscles are relaxed. During the exhalation phase, gently yet actively push the breath out of the abdominals. Inhalation for each Ai Chi movement should occur through the nose breathing easily into the belly with the stomach expanding while turning the palms up. Exhalation should occur easily through the mouth with the abdominal muscles contracting while turning the palms down. In Ai Chi, palms turn down while exhaling and palms turn up while inhaling.

**Upper Extremity Movements**
- Floating -- Alternating between shoulder extension and flexion
- Uplifting -- Alternating between shoulder abduction and adduction
- Enclosing -- Alternating between horizontal abduction and adduction
- Folding -- Alternating between horizontal abduction and adduction with elbows proximal to the trunk

**Trunk Stability Movements**
- Soothing -- Alternating between unilateral horizontal adduction and abduction
- Gathering -- Alternating between unilateral horizontal adduction and abduction in pivoted position
- Freeing -- Alternating between soothing and gathering
- Shifting -- Alternates unilateral horizontal ab/adduction with weight shifts
- Accepting -- In pivoted position, alternating between bilateral horizontal ab/adduction

**Lower Extremity Movements**
- Accepting with grace -- Alternates between hip flexion with horizontal abduction and hip extension with adduction
- Rounding -- Alternates between hip flexion with horizontal adduction and hip extension with abduction
- Balancing -- Alternates between hip flexion with shoulder extension and hip extension with flexion

**Total Coordinated Body Movements**
- Flowing -- LE crossovers while shoulders horizontally ab/adduct
- Reflecting -- Cross and pivot
- Suspending -- Simultaneously crossing UEs and LEs with pivot, then opens

**Special Considerations**
Although Ai Chi can be beneficial for many people, the same movements can’t and/or won’t be practiced the same way for everyone. There is no wrong way to practice Ai Chi. Repetitions, ROM, treatment duration, water depth, and speed of progression will depend on the patients’ individual needs.

**Auditory impairments**
- Stay on the deck (if safe) and demonstrate the movements
- Face the patient and repeat the commands several times
- Consider signals for getting out of the pool or stopping a specific exercise

**Cerebral Palsy**
- Encourage ROM work in a calm, “non-judgmental” atmosphere
- Consider decreasing the number of different movements for each treatment session
COPD

- Lengthen the warmup time
- Modify and/or decrease ROM to decrease energy expenditure
- Decrease water depth for more comfortable breathing
- Keep their bronchodilator at the pool’s edge
- Avoid eating two hours before their session
- Encourage fluid intake

CVA

- Encourage the patient to watch his or her movements
- Consider decreasing the number of movements for each treatment session (such as 2-3) to decrease frustration and increase the opportunity for success
- Begin with a ROM that will help the patient feel successful

Hip Replacement

- Omit movements not in line with the patient’s specific hip precautions

Low Back Pain

- Encourage slowness and control of movements with the focus more on alignment than the movements themselves
- Decrease ROM or water depth if the patient is having difficulty with alignment or posture
- Decrease the time, effort and ROM on the subsequent visit if the patient experiences more pain two hours after the session than before
- Have the patient pull the abdominals inward at the end of exhalation to encourage abdominal strength and core stability
- Encourage contracting the abdominals during buoyancy assisted hip extension as well as during the Trunk Stability exercises with the spinal rotation movements
- Keep the knees slightly bent during all spinal flexion movements

Knee Replacement

- Encourage knees that are slightly flexed
- Make sure movements are done slowly and with control
- Keep the knees and toes on each LE on the same longitudinal axis

Rheumatoid Arthritis

- Increase the warmup period
- Be particularly observant of having all extremities submerged
- Progress slowly and begin with a limited ROM
1) Slow diaphragmatic breathing ("Contemplating")
In the initial position, the patient’s feet are placed at least at shoulder width apart with the knees and toes pointed slightly outward. The knees and toes should remain in the same longitudinal axis (to each other) throughout the program. The knees are bent and should remain soft. The pelvis and spine should be in a neutral position. From a sagittal plane, the shoulders should be directly over the hips. The shoulders should drop away from the ears and the UEs are supported by the water close to the surface with the forearms pronated (palms down) and the thumbs touching each other. The cervical spine should be in neutral alignment. The therapist can have the patient think of the head being suspended from above. The chin should be in a relaxed position and pointed slightly down.

Using diaphragmatic breathing, the floor of the diaphragm moves downward pushing the abdominal organs down and forward during the inhalation phase. The abdominal muscles are relaxed. During the exhalation phase, gently yet actively push the breath out of the abdominals. Inhalation for each Ai Chi movement should occur through the nose (depending on the patient’s respiratory needs) breathing easily into the belly with the stomach expanding (while turning the palms up). Exhalation should occur easily through the mouth with the abdominal muscles contracting (while turning the palms down).

In Ai Chi, when the palms are turning down, we are exhaling.
When the palms are turning up, we are inhaling.

Movement summary
The patient alternates between the palms down with exhalation and palms up with inhalation.

Pictures
(Palms down with exhalation)  (Palms up with inhalation)

Step by step instructions
1. Inhale, turning the palms up (supination with shoulder ER).
2. Exhale, turning the palms down (pronation with shoulder IR).
3. Repeat steps one and two 5 – 10 times.
2) Upper extremity movements

“Floating”

Movement summary

The patient alternates between bilateral shoulder extension (with exhalation) and bilateral shoulder flexion (with inhalation).

Pictures

(UE position at the end of exhalation)  (UE position at the end of inhalation)

Step by step instructions -

1. Inhale, turning the palms up (supination with shoulder ER).
2. Exhale, turning palms down, with bilateral shoulder extension toward the thighs.
3. Inhale, turning palms up, with bilateral shoulder flexion toward the water surface.
4. Repeat steps two and three 5-10 times.
5. Exhale, turning the palms down, with bilateral shoulder extension toward the thighs.
“Uplifting”

Movement summary

The patient alternates between bilateral shoulder abduction (with inhalation) and bilateral shoulder adduction (with exhalation)

Pictures

(UEs at the end of inhalation)          (UEs in the process of exhalation)

Step by step instructions

1. Inhale, turning the palms up, with bilateral shoulder abduction toward the water surface.
2. Exhale, turning the palms down, with bilateral shoulder adduction toward the sides of the thighs.
3. Repeat steps one and two 5-10 times.
4. Inhale, turning the palms up, with bilateral shoulder abduction toward the water surface.
“Enclosing”

Movement summary

The patient alternates between bilateral horizontal shoulder adduction (with exhalation) and bilateral horizontal shoulder abduction (with inhalation).

Pictures

(UEs near the end of exhalation)   (UEs near the end of inhalation)

Step by step instructions

1. Exhale, turning the palms down, with bilateral horizontal shoulder adduction bringing the hands together until the thumbs touch.
2. Inhale, turning the palms up, with bilateral horizontal shoulder abduction to the side.
3. Repeat steps one and two 5-10 times (progressing to the next movement after inhalation).
“Folding”

Movement summary

The patient alternates between bilateral horizontal shoulder adduction past midline (with exhalation) and bilateral horizontal shoulder abduction with the elbows proximal to the trunk (with inhalation).

Pictures

(UEs at the end of exhalation)  (UEs at the end of inhalation)

Step by step instructions

1. Exhale, turning the palms down, with bilateral horizontal shoulder adduction and slight extension crossing the midline at navel height.
2. Inhale, turning the palms up, with bilateral horizontal shoulder abduction (with elbows remaining flexed and close to the trunk).
3. Repeat steps one and two 5-10 times.
4. Exhale, turning the palms down, with bilateral horizontal shoulder adduction and slight extension crossing the midline at navel height.
5. Inhale, turning the palms up, with bilateral horizontal shoulder abduction.
3) Trunk stability movements

“Soothing”

Movement summary

The patient alternates between unilateral horizontal shoulder adduction (with exhalation) and unilateral horizontal shoulder abduction (with inhalation).

Pictures

(At the end of exhalation – left UE)  (At the end of inhalation – left UE)

Step by step instructions

1. Exhale, turning the right palm down, with right unilateral horizontal shoulder adduction across midline to the other hand (with the hips facing forward and the body stable from the waist down).
2. Inhale, turning the right palm up, with right unilateral horizontal shoulder abduction (bringing the right arm back to the right side). The hips face forward and the body is stable from the waist down.
3. Repeat steps one and two 5-10 times progressing to the left upper extremity after inhalation.
4. Exhale, turning the left palm down, with left unilateral horizontal shoulder adduction across midline to the other hand (with the hips facing forward and the body stable from the waist down).
5. Inhale, turning the left palm up, with left unilateral horizontal shoulder abduction bringing the left arm back to the left side. The hips face forward and the body is stable from the waist down.
6. Repeat steps four and five 5-10 times progressing to the next movement after inhalation.

*If ROM is limited, do not force the movement creating torque at the knee. Either use less UE ROM or allow the LEs to pivot.*
“Gathering”

Movement summary

In a pivoted position, the patient alternates between unilateral horizontal shoulder abduction (with inhalation) and unilateral horizontal shoulder adduction (with exhalation).

Pictures

(In a right pivot at the end of inhalation)    (In a right pivot at the end of exhalation)

Step by step instructions

1. Exhale, turning palms down, with right unilateral horizontal shoulder adduction until the thumbs of both hands touch while pivoting the LEs 90 degrees so that the body will be facing the left. Body weight should be evenly distributed between the LEs.
2. Inhale, turning the left palm up, opening the left arm behind the body (left unilateral horizontal shoulder abduction) while still facing left (and not watching the moving hand).
3. Exhale, turning the left palm down, while performing left unilateral horizontal shoulder adduction to midline so that the thumbs are touching.
4. Repeat steps two and three 5-10 times.
5. Inhale, turning the right palm up, while moving the right hand to the side (right unilateral horizontal shoulder abduction) and pivoting the LEs 90 degrees so that the body is facing forward.
6. Exhale, turning the palms down, with left unilateral horizontal shoulder adduction until the thumbs of both hands touch while pivoting the LEs 90 degrees so that the body will be facing the right. Body weight should be evenly distributed between the LEs.
7. Inhale, turning the right palm up, opening the right arm behind the body (right unilateral horizontal shoulder abduction) while still facing right (and not watching the moving hand).
8. Exhale, turning the right palm down, while performing right unilateral horizontal shoulder adduction to midline so that the thumbs are touching.
9. Repeat steps seven and eight 5-10 times
10. Inhale, turning the palms up, while moving the left hand to the side (left unilateral horizontal abduction) and pivoting the LEs 90 degrees so that the body is facing forward.
"Freeing"

Movement summary

The patient combines and alternates the “Soothing” and “Gathering” movements while watching the moving hand.

Pictures

(At the end of inhalation) (At the end of exhalation) (At the end of inhalation)

Step by step instructions

1. Exhale with right unilateral horizontal shoulder adduction (while turning the palms down) until the thumbs of both hands touch while pivoting the LEs so that the body will be facing the left. Body weight should be evenly distributed between the LEs.
2. Inhale (while still facing left), turning the left palm up, while opening the left arm behind the body (left unilateral horizontal shoulder abduction) allowing the eyes and head to follow the moving arm.
3. Exhale, turning the left palm down, while performing left unilateral horizontal shoulder adduction to midline so that the thumbs are touching.
4. Inhale, turning the palms up, bringing the right arm back to the right side (unilateral horizontal shoulder abduction) while pivoting the LEs to the right 90 degrees so that the entire body is facing forward.
5. Exhale with left unilateral horizontal shoulder adduction (while turning the palms down) until the thumbs of both hands touch while pivoting the LEs so that the body will be facing the right. Body weight should be evenly distributed between the LEs.
6. Inhale (while still facing right), turning the right palm up, while opening the right arm behind the body (right unilateral horizontal shoulder abduction) allowing the eyes and head to follow the moving arm.
7. Exhale, turning the right palm down, while performing right unilateral horizontal shoulder adduction to midline so that the thumbs are touching.
8. Inhale, turning the palms up, bringing the left arm back to the left side (unilateral horizontal shoulder abduction) while pivoting the LEs to the left 90 degrees so that the entire body is facing forward.
9. Repeat all of the above steps 5-10 times.
“Shifting”

Movement summary

(“Soothing” with lunges) The patient alternates unilateral horizontal abduction/adduction with weight shifts.

Pictures

(At the end of exhalation)   (At the end of inhalation)

Step by step instructions

1. Exhale, turning the palm down, and performing right unilateral horizontal shoulder adduction across midline (until the thumbs touch) while weight shifting to the left LE. The weight shift does not occur until exhalation begins. The body remains facing forward.

2. Inhale (with weight still shifted to the left), turning the palm up, and watching/following the right hand as it returns to the right side (right unilateral horizontal abduction).

3. Exhale, turning the palms down, and performing left unilateral horizontal shoulder adduction (until the thumbs are touching) while weight shifting to the right.

4. Inhale (with weight still shifted to the right), turning the palm up, and watching/following the left hand as it returns to the left side (left unilateral horizontal abduction).

5. Repeat steps one through fours 5-10 times (progressing to the next movement after inhalation).
“Accepting”

Movement summary
In a pivoted position, the patient alternates between bilateral horizontal shoulder abduction (with inhalation) and bilateral horizontal shoulder adduction to midline (with exhalation).

Pictures

(In a right pivot at the end of inhalation)    (In a right pivot at the end of exhalation)

Step by step instructions

1. Exhale, turning the palms down, and performing right unilateral horizontal shoulder adduction past midline (until thumbs are touching) while pivoting the LEs to the left 90 degrees (so that the entire body is facing the left). Body weight should be evenly distributed between the LEs.
2. Inhale (still facing left), turning the palms up, bringing both arms back while opening the rib cage (bilateral horizontal shoulder abduction) and squeezing the scapulas together while weight shifting to the right (posterior) LE so that a slight backward lean is occurring.
3. Exhale (still facing left), turning the palms down and bringing both arms to midline (bilateral horizontal shoulder adduction) while weight shifting onto the left (anterior) LE so that a slightly forward lean is occurring.
4. Repeat steps two and three 5-10 times.
5. Inhale, turning the palms up, bringing the right arm back to the right side (unilateral horizontal shoulder abduction) while pivoting the LEs 90 degrees to the right for forward facing.
6. Exhale, turning the palms down, and performing left unilateral horizontal shoulder adduction past midline (until thumbs are touching) while pivoting the LEs to the right 90 degrees (so that the entire body is facing the right). Body weight should be evenly distributed between the LEs.
7. Inhale (still facing right), turning the palms up, bringing both arms back while opening the rib cage (bilateral horizontal shoulder abduction) and squeezing the scapulas together while weight shifting on the left (posterior) LE so that a slight backward lean in occurring.
8. Exhale (still facing right), turning the palms down and bringing both arms to midline (bilateral horizontal shoulder adduction) while weight shifting onto the right (anterior) LE so that a slightly forward lean is occurring.
9. Repeat steps seven and eight 5-10 times.
10. Inhale, turning the palms up and bring the left arm back to the left side (unilateral horizontal shoulder abduction) while pivoting the LEs 90 degrees to the left for forward facing.

4) Lower extremity movements
“Accepting with grace”

Movement summary
In a pivoted position, the patient alternates between anterior LE hip flexion during bilateral horizontal shoulder abduction (with inhalation) and anterior LE hip extension to the pool floor during bilateral horizontal shoulder adduction to midline (with exhalation).

Pictures

(In a right pivot at the end of exhalation) (In a right pivot toward the end of inhalation)

Step by step instructions
1. Exhale, turning the palms down, and performing right unilateral horizontal shoulder adduction past midline (until thumbs are touching) while pivoting the LEs to the left 90 degrees (so that the entire body is facing the left). Body weight should be evenly distributed between the LEs.
2. Inhale (still facing left), turning the palms up and bringing both arms back and opening the rib cage (bilateral horizontal shoulder abduction). At the same time, weight shift to the posterior LE (right), lean back slightly and lift the anterior LE (left) off the pool floor. Sova recommends thinking of floating back and not arching too much to keep the back safe (AI Chi).
3. Exhale (still facing left), turning the palms down, and bringing both arms to midline (horizontal adduction until the thumbs touch) while lowering the left leg to the pool floor, and returning the trunk to an upright position. Repeat steps two and three 5-10 times.
4. Inhale, turning the palms up, and bringing the right arm back to the right side (right unilateral horizontal shoulder abduction) while pivoting the LEs 90 degrees to the right so that the entire body is facing forward.
5. Exhale, turning palms down, and performing left unilateral horizontal shoulder adduction past midline (until thumbs are touching) while pivoting the LEs to the right 90 degrees (so that the entire body is facing the right). Body weight should be evenly distributed between the LEs.
6. Inhale (still facing right), turning the palms up and bringing both arms back and opening the rib cage (bilateral horizontal shoulder abduction). At the same time, weight shift to the posterior LE (left), lean back slightly, and lift the anterior LE (right) off the pool floor.
7. Exhale (still facing right), turning the palms down, and bringing both arms to midline (horizontal adduction until the thumbs touch) while lowering the right LE to the pool floor, and returning the trunk to an upright position. Repeat steps six and seven 5-10 times.
8. Inhale, turning the palms up, and bringing the left arm back to the left side (left unilateral horizontal shoulder abduction) while pivoting the LEs 90 degrees to the left so that the entire body is facing forward.
“Rounding”

**Movement summary**
The patient alternates between hip flexion of the posterior LE during bilateral horizontal shoulder adduction (with exhalation) and hip extension with bilateral horizontal shoulder abduction (with inhalation).

**Pictures**

(In a right pivot at the end of inhalation) (In a right pivot toward the end of exhalation)

**Step by step instructions**

1. Exhale, turning the palms down, and performing right unilateral horizontal shoulder adduction past midline (until thumbs are touching) while pivoting the LEs to the left 90 degrees (so that the entire body is facing the left). Body weight should be evenly distributed between the LEs.

2. Inhale (still facing left), turning the palms up, and bringing the arms back/opening up the rib cage (bilateral horizontal shoulder abduction) while weight shifting to the posterior LE (right) creating a slightly backward lean.

3. Exhale (still facing left), turning the palms down, and bringing both arms to midline (bilateral horizontal shoulder adduction) until the thumbs touch. At the same time, perform hip flexion of the posterior LE (right), bringing the toes of the right foot toward the fingers (while creating a slight forward lean). Repeat steps two and three 5-10 times.

4. Inhale, turning the palms up, and bringing the right arm back to the right side (right unilateral horizontal shoulder abduction) while pivoting the LEs 90 degrees to the right so that the entire body is facing forward.

5. Exhale, turning the palms down, and performing left unilateral horizontal shoulder adduction past midline (until thumbs are touching) while pivoting the LEs to the right 90 degrees (so that the entire body is facing the right). Body weight should be evenly distributed between the LEs.

6. Inhale (still facing right), turning the palms up, and bringing the arms back/opening up the rib cage (bilateral horizontal shoulder abduction) while weight shifting to the posterior LE (left) creating a slightly backward lean.

7. Exhale (still facing right), turning the palms down, and bringing both arms to midline (bilateral horizontal shoulder adduction) until the thumbs touch. At the same time, perform hip flexion of the posterior LE (left), bringing the toes of the left foot toward the fingers (while creating a slight forward lean). Repeat steps six and seven 5-10 times.

8. Inhale, turning the palms up, and bringing the left arm back to the left side (left unilateral horizontal shoulder abduction) while pivoting the LEs 90 degrees to the left so that the entire body is facing forward.
“Balancing”

Movement summary

The patient alternates between hip flexion of the posterior LE with bilateral shoulder extension (during inhalation) and hip extension with shoulder flexion (during exhalation).

Pictures

(In a right pivot toward the end of inhalation)  (In a right pivot at the end of exhalation)

Step by step instructions

1. Exhale, turning the palms down, and performing right unilateral horizontal shoulder adduction past midline (until thumbs are touching) while pivoting the LEs to the left 90 degrees (so that the entire body is facing the left). Body weight should be evenly distributed between the LEs.
2. Inhale (still facing left), turning the palms up, and performing bilateral shoulder extension while performing posterior LE hip flexion (right) and creating a slight forward lean.
3. Exhale (still facing left), turning the palms down, and performing bilateral shoulder flexion (toward the water’s surface) while extending the right hip with gentle knee flexion (without weightbearing) and leaning forward (“superman”).
4. Repeat steps two and three 5-10 times without weightbearing on the right.
5. Inhale, turning the palms up, and returning the right arm to the right side (unilateral horizontal shoulder abduction) while bringing the right foot to the pool floor and pivoting the LEs to the right 90 degrees so that the entire body is facing forward.
6. Exhale, turning the palms down, and performing left unilateral horizontal shoulder adduction past midline (until thumbs are touching) while pivoting the LEs to the right 90 degrees (so that the entire body is facing the right). Body weight should be evenly distributed between the LEs.
7. Inhale (still facing right), turning the palms up, and performing bilateral shoulder extension while performing posterior LE hip flexion (left) and creating a slight forward lean.
8. Exhale (still facing right), turning the palms down, and performing bilateral shoulder flexion (toward the water’s surface) while extending the left hip with gentle knee flexion (without weightbearing) and leaning forward.
9. Repeat steps seven and eight 5-10 times without weightbearing on the left.
10. Inhale, turning your palms up and returning the left arm to the left side (unilateral horizontal shoulder abduction) while bringing the left foot to the pool floor and pivoting the LEs to the left 90 degrees that the entire body is facing forward.
5) Total coordinated body movements

“Flowing”

Movement summary

The patient performs LEs crossovers while the shoulders bilaterally horizontally abduct and adduct across midline at the navel. When the UEs are in an open (horizontally abducted) position, the LEs are crossed (adducted). When the UEs are crossed, the LEs are open.

Pictures

(At the end of exhalation – moving right) (At the end of inhalation-moving right)

Step by step instructions

1. Exhale, turning the palms down, while lowering and crossing the arms in front of the body (bilateral horizontal shoulder adduction past midline with slight extension and elbow flexion) with the knees and toes pointed outward.
2. Inhale, turning the palms up, maintaining the elbows close to the trunk and performing bilateral horizontal shoulder abduction while crossing the right LE over the left (with a slight knee bend).
3. Exhale, turning the palms down, while lowering and crossing the arms in front of the body (bilateral horizontal shoulder adduction past midline with slight extension) while stepping to the left with the left LE (abduction).
4. Repeat steps two and three 5-10 times to the left.
5. Inhale, turning the palms up, maintaining the elbows close to the waist and performing bilateral horizontal shoulder abduction while crossing the left LE over the right (with a slight knee bend).
6. Exhale, turning the palms down, lowering and crossing the arms in front of the body (bilateral horizontal shoulder adduction past midline with slight extension) while stepping to the right with the right LE (abduction).
7. Repeat steps five and six 5-10 times to the right.
8. Inhale, turning the palms up, keeping the elbows close to the trunk and performing bilateral horizontal shoulder abduction.

“Reflecting”
Movement summary

(“Cross and pivot”) The patient performs bilateral horizontal shoulder adduction crossing midline at the navel as one LE simultaneously adducts past midline (crossover). The UEs will adduct past midline (crossing right over left) as the right LE adducts past midline (right over left) followed by a pivot. Then the UEs will adduct past midline (crossing left over right) as the left LE adducts past midline followed by a pivot.

Pictures

(Exhalation: R over L) (After pivoting end of inhalation)

Step by step instructions

1. Exhale, turning the palms down, and lowering and crossing the arms (right over left) in front of the body (bilateral horizontal shoulder adduction past midline with slight extension). Simultaneously, cross the right LE over the left (with the knees slightly bent).
2. Inhale, turning the palms up, maintaining the elbows close to the trunk and performing bilateral horizontal shoulder abduction while pivoting to the left 180 degrees (to face backwards).
3. Exhale, turning the palms down while crossing (left over right) and lowering the arms in front of the body and crossing the left LE over the right (with the knees slightly bent).
4. Inhale, turning the palms up, maintaining the elbows close to the trunk and performing bilateral horizontal shoulder abduction while pivoting to the right 180 degrees to face forward.
5. Exhale, turning the palms down, while crossing (left over right) and lowering the arms in front of the body and crossing the left LE over the right (with the knees slightly bent).
6. Inhale, turning the palms up, maintaining the elbows close to the trunk and performing bilateral horizontal shoulder abduction while pivoting to the right 180 degrees (to face backwards).
7. Exhale, turning the palms down, and lowering and crossing the arms (right over left) in front of the body (bilateral horizontal shoulder adduction past midline with slight extension). Simultaneously, cross the right LE over the left (with the knees slightly bent).
8. Inhale, turning the palms up, maintaining the elbows close to the trunk and performing bilateral horizontal shoulder abduction while pivoting to the left 180 degrees to face forward.
9. Repeat steps one through eight 3-6 times.
“Suspending”

Movement summary

The patient simultaneously crosses right over left (UEs and LEs) then pivots and opens (abducts). Then the patient simultaneously crosses (adducting) left over right then pivots and opens.

Pictures

![At the end of exhalation](image1)

![At the end of inhalation](image2)

Step by step instructions

1. Exhale, turning the palms down, and lowering and crossing the arms in front of the body (bilateral horizontal shoulder adduction past midline with slight extension). Simultaneously, pull both knees up crossing the right foot over the left attempting to stay suspended. If landing is needed, the right foot should land crossed over the left (still facing forward). The shoulders should stay beneath the surface of the water throughout.
2. Inhale, turning the palms up, maintaining the elbows close to the trunk and performing bilateral horizontal shoulder abduction. Simultaneously, pivot the body to the left for backward facing.
3. Exhale, turning the palms down, and lowering and crossing the arms in front of the body (bilateral horizontal shoulder adduction past midline with slight extension). Simultaneously, pull both knees up crossing the left foot over the right attempting to stay suspended. If landing is needed, the left foot should land crossed over the right. Shoulders should stay beneath the surface of the water throughout.
4. Inhale, turning the palms up, maintaining the elbows close to the trunk and performing bilateral horizontal shoulder abduction. Simultaneously, pivot the body to the right for forward facing.
5. Repeat steps one through four 5-10 times.
6. Exhale, turning the palms down, and lowering and crossing the arms in front of the body (bilateral horizontal shoulder adduction past midline with slight extension). Simultaneously, pull both knees up crossing the left foot over the right attempting to stay suspended. If landing is needed, the left foot should land crossed over the right (still facing forward). The shoulders should stay beneath the surface of the water throughout.
7. Inhale, turning the palms up, maintaining the elbows close to the trunk and performing bilateral horizontal shoulder abduction. Simultaneously, pivot the body to the right for backward facing.
8. Exhale, turning the palms down, and lowering and crossing the arms in front of the body (bilateral horizontal shoulder adduction past midline with slight extension). Simultaneously, pull both knees up crossing the right foot over the left attempting to stay suspended. If landing is needed, the right foot should land crossed over the left. Shoulders should stay beneath the surface of the water throughout.
9. Inhale, turning the palms up, maintaining the elbows close to the trunk and performing bilateral horizontal shoulder abduction. Simultaneously, pivot the body to the left for forward facing.
10. Repeat steps six through nine 5-10 times.
Examples of abdominal strengthening

1. With the patient positioned in standing with the buttocks touching the pool wall, the knees slightly flexed, and the feet shoulder width apart and slightly forward, the patient performs pelvic tilts with holds. The low back goes flat to the pool wall and then moves away.

2. With the patient’s elbows resting on the pool’s edge and the feet raised (with the hips and knees at 90/90), the patient moves the knees anteriorly (with the tail bone moving away from the wall) and posteriorly (with the tail bone moving toward the wall).

Examples of back stretches

1. The patient brings one knee to his or her chest and holds the unilateral flexed hip position with the UEs, while maintaining the trunk in an upright position.

2. With the patient facing the pool’s edge and the patient’s elbows over the edge/in the gutter, both knees are raised up to the chest and the patient presses the naval back and leans forward over the knees.

Examples of piriformis stretches

1. On a pool step, the patient can lift and cross one LE so that the foot of one LE is resting on the opposite knee. He or she can then use the contralateral hand to move the flexed knee toward the opposite pelvis (up and in).

2. In a standing position, the patient can place/lift and cross one LE so that the foot of one LE is resting on the opposite knee. While facing and holding the pool’s edge or rail, the patient can slowly bend the weight bearing LE lowering him or herself further into the pool.
Bad Ragaz

Bad Ragaz is commonly used for tone inhibition, muscle relaxation, shortened muscle elongation, and progressive muscle strengthening. It is often known today as the Bad Ragaz Ring Method. Bad Ragaz is considered an aquatic muscle re-education technique. It is similar to PNF and utilizes floatation equipment to support the patient. The therapist must interact one-on-one with the patient. The concepts of Bad Ragaz include relaxation, tone inhibition, ROM, elongation, resistance and endurance.

There are a number of Bad Ragaz patterns or techniques that can be used depending on the patient’s individual needs. These techniques can be classified in a variety of ways. For example, the patterns can be categorized as passive or active command patterns. Passive patterns do not have active patient participation. Active patterns rely on the patient’s cognitive ability to perform the specific movements that the therapist requests (by giving short commands). The active patterns can be further classified as isometric, isotonic, and isokinetic patterns. These patterns can be modified for a variety of neurological or orthopedic conditions. Patients benefiting from Bad Ragaz include those with pain, spasticity, low tone, decreased coordination and proprioceptive deficits.

Guidelines

An area of at least 8 ft x 8 ft with a depth of 3-4 ft is needed for Bad Ragaz. Ideally, the therapist stands in water depth of T8 – T11. Water depths greater than T8 can decrease the stability of the therapist. The therapist should wear aquatic shoes with arch support and be aware of his or her own body mechanics. Water should be warm in temperature, such as 92 degrees for neutral warmth. Floatation equipment will be needed. This typically includes a cervical floatation collar, a pelvic floatation device and may require arm/wrist floatation and/or knee/ankle floatation support. Equipment size will depend on the patient’s size, density and tone needs. The neck should be in a neutral position with the cervical floatation collar. The pelvic support should be placed under S2 maintaining the pelvis in a neutral position. Correct positioning of equipment and patient alignment is essential. Floatation equipment/support at the knee/ankle or arm/wrist can be placed more proximally if support is needed.

Passive Relaxation

This position is intended to relieve pain and promote relaxation. It can also be used for LE extensor spasticity. It is considered more of a position than an actual pattern. The patient is positioned in supine with a cervical floatation collar, a pelvic floatation belt and a noodle under the knees.

Passive Patterns

With passive patterns, the patient is moved slowly through the water by the therapist for relaxation, tone inhibition and trunk elongation. This can be done with swinging, rocking and/or rolling. Examples include passive pelvic tilts as well as trunk elongation with a variety of holds.

- Passive pelvic tilt: patient is positioned in supine with floatation devices at the neck, pelvis, and ankles. With the therapist standing between the patient’s thighs and holding onto the sides of the patient’s pelvis (thumbs at the ASIS/the four medial digits around the iliac crest), the therapist tilts the pelvis posteriorly by pressing down on the ASIS and then allows the pelvis to return to its original position.
- Passive trunk elongation (using a pelvic hold): therapist stands between the patient’s thighs with a wide base of support and holds the patient’s iliac crests. The patient is positioned in supine (wearing floatation devices). The therapist rocks the patient from side to side. This is done by pulling caudally on each iliac crest alternately. The therapist can also facilitate trunk rotation in this position by pressing one ASIS posteriorly and simultaneously pressing the PSIS on the other side of the body anteriorly. (This pattern is contraindicated for patient’s s/p spinal fusion.)
- Passive trunk elongation (using a thoracic hold): therapist stands at the head of the patient with a wide base of support and the hands placed on and just caudal to the scapular area of the back with the thumbs near the axillary folds. The patient is positioned in supine. The therapist gently moves the patient from side to side. In addition to facilitating lateral trunk flexion, the therapist can add gentle rotation by pushing up (anteriorly) on one side and then the other. (This pattern is contraindicated for patient’s s/p spinal fusion.)
• Passive trunk elongation (using an elbow hold): therapist stands at the head of the patient with a wide base of support with the hands placed at the patient’s elbows. The patient is positioned in supine with hands holding the floatation collar (with shoulder external rotation and elbow flexion). The therapist moves the patient gently from side to side. (This pattern is contraindicated for patients who are s/p spinal fusion.)

Isometric Pattern
With an isometric pattern, the patient is moved through the water by the therapist to improve stability. The patient works to maintain or hold a fixed position against the resistance of moving across the water.
• Isometric trunk (with a thoracic hold): therapist stands at the patient’s head with the hands placed on and just caudal to the scapular area of the back with the thumbs near the axillary folds. The patient is positioned in supine. The therapist asks the patient to hold his or her position when moved through the water. The therapist moves the patient to the left and to the right.
• Isometric trunk (with an elbow hold): therapist standing at the patient’s head and the patient positioned in supine and holding the patient at the elbows, the therapist asks the patient to hold her position when moved through the water. The therapist moves the patient to the left and the right.

Isotonic Pattern
With an isotonic pattern, the therapist is the stabilizing force and also moves through the water with the patient. The therapist controls the graded resistance and can assist the patient’s movement or resist it. The patient actively moves while being moved in the water.
• Isotonic trunk: therapist stands at the patient’s head. The patient is positioned in supine. The therapist can give the patient verbal commands to bring both legs to the right keeping the knees together while pointing the hips and toes toward the ceiling. The therapist can stabilize the patient and follow the direction of the patient’s movement to decrease resistance. The pattern can be progress by having the therapist move in the opposite direction of the patient’s movement to increase resistance.

Isokinetic Patterns
With isokinetic patterns, the therapist stabilizes or anchors one part of the body while the patient moves toward, around, or away from the therapist through the water. The patient’s speed of movement determines the amount of resistance.
• Isokinetic LE: therapist stands at the patient’s feet with the patient’s feet resting on the therapist’s chest. The therapist’s hands are placed on the dorsal surface of the patient’s feet. The patient is positioned in supine. The therapist gives the verbal command to “push your feet against my chest while straightening your legs.”

Progressions
There are a variety of progressions that can be used with the Bad Ragaz Ring Method.
• The therapist can move the patient at a greater speed through the water with isometric patterns
• When using isotonic or isokinetic patterns, the patient can be instructed to perform the active movements at a greater speed
• The therapist’s hands can be placed more distally on the patient to lengthen the lever arm so that the patient has to move or stabilize more of his body through the water
• Turbulence can be added by the therapist to increase resistance to active isotonic or isokinetic movements as well as make isometrics more challenging to maintain
• UE or LE PNF patterns can be added using correct hand positions, approximation, traction, short precise commands and graded resistance. PNF patterns can be used unilaterally or bilaterally. Bilateral patterns can be symmetrical or reciprocal.
Special Considerations

Neurologic
- Passive patterns are often most appropriate initially secondary to tone issues
- Patterns that encourage trunk elongation and shoulder/pelvic dissociations can be beneficial
- Patterns that can increase hypertonicity should be avoided
- Patients status post CVA will often times roll toward their involved side when positioned in supine.

Back Surgery
- Be aware of each patient’s specific contraindications after any back surgery
- Avoid or modify the activities that incorporate them
- For patient’s s/p spinal fusion, trunk patterns with rotation or lateral side bending should be avoided
RESOURCES: CATALOGS, PRODUCTS, EQUIPMENT

Aqua Gear, Inc.
Phone: 888-426-4327
Website: [www.aqua-gear.com](http://www.aqua-gear.com)
(Aquatic therapy and swimming equipment)

Blue Moon ® Aqua Products
TRMN Enterprises, Inc.
Phone: 800-944-1176
Website: [www.bluemoonswim.com](http://www.bluemoonswim.com)
(Flotation equipment)

Kiefer
Phone: 800-323-4071
Website: [www.kiefer.com](http://www.kiefer.com)
(Aquatic therapy equipment)

Water Gear, Inc.
Phone: 800-794-6432
Website: [www.watergear.com](http://www.watergear.com)
(Aquatic therapy and swimming equipment)

RESOURCES: EDUCATIONAL AND ORGANIZATIONS

Aquatic Exercise Association
P.O. Box 1609
Nokomis, FL 34274-1609
Website: [www.aeawave.com](http://www.aeawave.com)
(Aquatic exercise and therapy books, videos and workshops on aquatic fitness)

Aquatic Resources Network
302 160th Street Suite 200
Amery, WI 54001
Website: [www.nvi.com/aquaticnet](http://www.nvi.com/aquaticnet)

Aquatic Therapy & Rehab Institute (ATRI)
13297 Temple Blvd.
West Palm Beach, FL 33412-2382
Website: [www.atri.org](http://www.atri.org)
(Workshops, symposiums, Aquatic Therapy and Rehabilitation Industry Certification, Rheumatology Certification, Ai Chi Certification)

International Council for Aquatic Therapy and Rehabilitation Industry Certifications
2829 S. Manito Blvd.
Spokane, WA 99203
Website: [www.icatric.org](http://www.icatric.org)

YMCA of USA
101 N. Wacker Drive, 14th Floor
Chicago, IL 60606
Website: [www.ymca.net](http://www.ymca.net)