AQUATIC THERAPY in ATHLETICS

Avoiding a frightful experience
Aquatic Therapy

- History & Purpose
- Principles
- Physiology
- Pool Specs
- Techniques
- Management
Purpose of Aquatic Therapy

The purpose of aquatic therapy is ultimately to make the athlete more functional on land, in a faster time frame.

In the process, the athletic trainer must assure a safe and appropriate pool environment for their rehab.
History of Athletic Aquatic Therapy

- **CHINA**: first documentation of therapeutic use—hundreds of years BC
- **ANCIENT ROME**: water used for healing and promoting youth
- **GERMANY**: very active with pediatric water therapy, and even water birthing in the late 1960’s and 1970’s. Adapted tank in Munich after 1972 Olympics for athletic rehab
- **USA**: started to emerge in therapy in 1980’s, but used in adaptive swimming for handicapped prior to the 1980’s.
US Athletic Aquatic Therapy History

- Started to gain slow popularity in athletic environments in mid 1990’s.
- Popularity in elite horses before elite human athletes
- USOC received its first tank in 1990’s although it did use lap pool to a small degree prior
History of Popular Pre-Made Units

SWIMEX
Founded in 1986
Known for water resistance systems

HYDROWORX
1987 founder got idea of underwater treadmill after seeing horse water treadmill

Suggest going to their web sites for more information & comparison
History con.

Therapeutic System's AquaArk founded in 1986. Early units included stainless steel and lifts.

Endless Pools
Founded in 1988
Cost about the same as a hot tub to operate.
Resistance jets

Suggest going to their websites for more information & comparison.
Before (and after) the pre-fab...

- Regular pools and hot tubs were used.
- Advantage of Pre-fab: less use of chemicals and energy, usually less space, can be moved if facility moves, usually better jets etc., easier to put into pre-existing spaces.
- Advantage of custom pool: more flexibility with design, less expensive to build (1/3?) but generally in the ground so you should own your building and plan to stay there.

*Air quality systems are an important aspect in planning, and must be strongly considered especially with larger pools.*
PRINCIPLES & EFFECTS OF WATER

- Buoyancy
- Moment of Force
- Density
- Hydrostatic Pressure
- Cohesion
- Viscosity
BUOYANCY

- When a body is in the water there is an upward push equal to the weight of the fluid the object displaces in the water.
- Can be used to be **assisted by**, or **resistant to** the water.
- The buoyancy of the water can help promote weightlessness; the human body can be supported by the water’s buoyancy.
Moment of Force

- The position of the limb influences the ability of buoyancy to assist pushing the limb to the surface- the more horizontal the more buoyancy
- Adding flotation devices to a limb will also increase the buoyancy
- The position representing the turning effect of buoyancy on a joint is known as the moment of force. (The longer the lever arm, the greater the torque produced by buoyancy)
- Relates to Center of Buoyancy (COB): if you increase the distance between the COB of the limb and the limb’s moving joint, the amount of buoyancy will increase.
Equipment Options

- Noodles instead of more expensive floatation devices for buoyancy
BUOYANCY & WEIGHT BEARING

• The deeper you are in the water, the more buoyant you are; your weight bearing % goes down.

• With an average body type, the general % weight bearing you find at different depths are:
  • Neck- 10% (you unload 90% of BW)
  • Chest- 25%
  • Waist-50%
Pre-fab advantage

- Some pre-made therapy pools come with a floor that raises to allow for these varying depths

Swimex.com

Hydroworx.com
The specific gravity (also called relative density) of water is “1”

If something has a specific gravity less than 1, it will float; if greater than 1 it will sink.

The human body has an average specific gravity of .97, with athletic population being somewhat higher. If there is more fat the specific gravity will become smaller, and if there is a lower % fat/higher lean mass the specific gravity of the human body will increase.

Air in the lungs, and air bubbles in the hair etc, will also promote flotation

Lower extremities tend to be more dense than UE’s.
Leaner Athletes

• Therefore, athletes with a lower percent body fat may have more difficulty floating.

• Waist floats or other assistive devices may have to be worn in deeper water, especially if the athlete is not a swimmer.
HYDROSTATIC PRESSURE

- Pressure from the water exerted on the body
- The deeper you go in the water, the greater the pressure (deeper water changes usually does not effect us in rehab that much- more with deep sea diving etc)
- Cardiac Output = heart rate x stroke volume
- (Starlings Law) In pool the stroke volume increases because of greater hydrostatic pressure causing greater peripheral blood flow return
- Since SV increases, hypothetically if CO stays the same, the HR will have to drop (HR drops ave 10-15% compared to land)
Hydrostatic Pressure & Monitoring Requirements

Pressure causes increased peripheral fluid return—decreased edema and increased diuresis

- Patients must have bladder control and advise to empty bowels and bladder before entering the pool.
- Due to pressure, lung capacity should be at least 1500cc to avoid collapse.
- HR changes: need to take HR on eval for all cardiac patients at risk, and have to instruct in self HR monitoring while in pool.
- Respiratory Clients: due to 1500cc requirements, need to take vital capacity measurement w/ hand spirometer at eval to assure OK.
- All at risk clients: teach RPE (rate of perceived exertion scale) and advise to notify therapist if any potential problems/difficulty.

- Clients in Aquatic Therapy Program should be able to talk freely while exercising. If unable to do this, clients may be overexerting themselves and the program should be lowered.
COHESION & VISCOSITY

- Cohesion is the tendency of the molecules of water to stick together. **As you move faster in the water, cohesion increases providing more resistance**
- Viscosity is the degree of friction acting on the body as it moves in the water. Again, the faster you move, the more friction and more resistance.
- These properties help give water their **quasi-isokinetic** affect.
Fluid Dynamics

Turbulent blood flow will produce an increase in pressure behind your body. Drag is the result of this. Someone standing tight behind you will have less drag due to Eddy currents - person in front will have more drag.
SURFACE AREA

• The greater the surface area, the more resistance. Ex) putting a sock in your hand to do shoulder 90x90’s will provide more surface area and more resistance.

• Water tends to provide about 15x’s the resistance of air. If you increase your speed in the water, you increase cohesion, increase viscosity, increase drag, and as limbs move away from the body you even increase surface area.
Options to surface area equipment

- Wear sock on hand or foot to improve surface area
1. Blood displaces upward to great vessels and chest cavity
2. Central blood volume increases 60%
3. Central venous pressure increases
4. Right atrial pressure increases about 16mm w/ immersion to neck
5. Cardiac volume increases almost 30%, stretching the myocardium & activating greater contractions- Starlings Law
6. Stroke volume increases about 35% w/ neck immersion changing end-diastolic volume
7. Cardiac Output increases about 23% w/ neck immers.
Circulatory con.

8. HR increases 10-15% (moe in water 97 deg.+) therefore resting in pool has to be based upon about 10% less than land

9. Peripheral resistance increases in cold water but decreases in warm water


11. HR is 8-11 bpm lower in chest deep compared to waist deep water

12. Since HR is dependent on so many factors and varies in different depth water, Borg’s Rate of Perceived Exertion (RPE) Scale is a good tool to use while client is in the pool.
1. Vital capacity decreases about 10% in neck immersion (a little less than half due to hydrostatic forces such as upwards displacement of the diaphragm, and a little more than half due to increased thoracic blood volume)

2. A negative pressure during inspiration occurs due to lung pressure (mouth being out of water and leading to lungs) being about 27.2mm Hg less than hydrostatic pressure on the chest

3. Total work for breathing increases about 60% w/ neck immersion

4. Healthy people show little change with respiratory function in the water
1. Buoyancy and hydrostatic pressure increase extracellular fluid flow and decrease edema by compressing soft tissue and improving lymphatic flow.

2. Blood supply to muscles is increased – O2 to muscles increases and removal of metabolic waist/lactate is increased.

3. Warm water and increased blood flow promote muscular relaxation

4. Decrease in gamma fiber activity helps inhibit spastic muscles

5. Decreased joint compression occurs
Immersion in water causes blood volume centralization (due to increase atrial natriuretic factor ANF, & decreased antidiuretic hormone (ADH)) which leads to:

1. Diuresis
2. Plasma volume loss
3. Increased sodium loss (up to 10x more than normal)
4. Suppression of thirst
5. Increased potassium loss
6. Mobilization of the extracellular fluid
Urinary con.

7. Renal response increases with increased depth of water
8. Fear and anxiety promotes diuresis
9. Cold water increases vasoconstriction which increases renal response
10. The renal response is greater and occurs faster with the elderly
1. Level of water, level of exertion, and water temperature can affect body temperature
2. Water immersion decreases sympathetic nervous system activity (decreased epinephrine and norepinephrine)
3. Chlorine and bromine can cause skin irritations. Exposure to these chemicals and water makes skin more fragile.
4. The vestibular system can be easily over-stimulated in water
5. You lose body heat 27 x’s faster when in water compared to land
6. To avoid dehydration, it’s ok to bring bottled water to drink while in the pool.
7. Caution regarding the fear response
INDICATIONS FOR AQUATIC THERAPY

• Weight bearing restrictions
• Decrease in pain
• Promote early mobility due to limited ROM
• Increased circulation
• Assist in coordination, proprioception & balance, especially with core stabilization
• Help w/ neuromotor timing
• Assists w/ sensory integration, especially w/ pediatrics
• Great motivational & psychological tool
• Help improve activity w/ deconditioned clients or those who cannot tolerate more vigorous land exercise
**PRECAUTIONS**

- Respiratory conditions such as COPD
- Cardiac conditions
- Complications w/ pregnancy (avoid exercising in water equal or greater than 90 degrees w/ pregnancy)
- Decrease core temp, low % fat-may get too cold for client
- Ear conditions where water in ear must be avoided
- **Braces- plaster no good unless in protective waterproof boot. Some braces ok- careful w/ floating etc**
- Anxiety of water
- Diabetes- need to avoid dehydration and control sugar-client should monitor sugar before starting exercise
- Medications that could alter cognition
- Tactile or temperature hypersensitivity
- Orthostatic hypotension
- For liability reasons, some require that a client must be able to stand independently in water in order to enroll in aquatic therapy program
- Independence or the need for assistance for dressing etc should be considered.
- **Open wounds (must be sealed with protective covering)**
- Clear with doctor first if client has history of allergies to pool chemicals
- **IT IS VERY EASY FOR A CLIENT TO OVERWORK IN THE WATER**
- Any precaution on land would also be precaution in the water
CONTRAINDICATIONS

- Very unstable vital signs
- Lung capacity <1500 cc
- Frequent or uncontrolled seizures
- Excessive fear/phobia of water
- Uncontrolled incontinence
- Psychological or emotional status that could put the client or health professional at risk in the water
- Very fragile client
- Open wounds/stomas/trachs (may be done w/ caution if fully covered w/ non-permeable membrane or protected for patient & others)
POOL CONSIDERATIONS

• What is temperature?
• Are there locker rooms?
• Will a lifeguard be on duty?
• Is pool depth adequate?
• Are there times the school will let you use the pool when lap swimming or disruptive play is not occurring?
• Do you have equipment? (noodles, kick board, aquajogger, ankle floats, barbells, hand paddles)
• Are non skid shoes worn on pool deck? In pool?
TECHNIQUES

• Watsu: Asian water form of Zen Shiatsu. Slow gentle stretching in 96-98 deg H20. Deep breathing/ shiatsu acupressure/sway/cradle clients through water

• Bad Ragaz: (“Bah Rahgah”) Bad Ragaz, Switzerland- Now uses a lot of PNF/ traditional form uses a lot of hula hoops for floats-known as “ring method”

• Halliwick: English – came from adaptive swimming techniques/ uses 10 step approach emphasizing posture

• Ortho Approach- used for sports medicine and orthopedics
Many times athletes receive some combination of pool and land rehab. Example: First visit on land for eval, HEP instruction, f/b modalities prn for control of sx’s/ Add aquatic therapy for the promotion of early gentle motion. As patient can tolerate more activity, first try in pool and then slowly progress to exercise combo in pool and land, and finally to land only.
ORTHOPEIC AQUATIC THERAPY TECHNIQUE

• Start with 5 minutes of warming up—usually walking width of pool.

• Second Part: stretching—similar to land. Hold 15-30 seconds and repeat 3-5 times. Water principles (like putting floatation around ankle and letting leg float upward for hamstring stretch) can also be used, but be careful of overstretching!
Third: Strengthening-
Think outside the box! Apply basic principles and exercises you would use on land, and do the same motions in water. Instead of weights use the speed and resistance of /in water, buoyancy/float devices, and surface areas to provide increased resistance. Your sets and reps should be muscle and activity specific (ex 3 sets of 6 max, vs 1 set of 50 reps) Start slow and lower reps- increase over progression sessions as tolerated. REMEMBER- A LOT OF CLIENTS DO NOT REALIZE HOW HARD THEY ARE ACTUALLY WORKING IN WATER – BE CAREFUL NOT TO OVEREXERT
Ortho Techniques con.

Fourth: Deep Water Activity
make sure client is not fearful of deep water. Great for gravity minimized requirements. Can do strengthening exercises such as pendulum, can do balance exercise (sit on noodle), or can do endurance exercises (bike while holding onto noodle, Aquajogger tethered, barbells running Hydrotones cross country, treading water (hands up makes harder)
ORTHO TECHNIQUE con.

Laps

Use snorkel & mask if CV problem (CV neutral); UBE with or without paddles, floater between legs for UE work only; flippers/kickboard for LE only etc. If walking laps wear pool shoes or sneakers to avoid injury.
Ortho Techniques, con.

Water Traction

great way to unload spine;
hand with noodle, barbells-
can use ankle weights but just
for proper axial alignment, not
as actual traction weight. Can
get tremendous, instantaneous
relief but sometimes only
temporary

Under Water Weighing
To determine percent body fat
ORTHOTO TECHNIQUE
con.

• Fifth: Functional Activities
  - Examples are hammering under water, putting paddle on a golf club head and swinging under water, swing tennis racket under water, performing ice skating routine (w/ and w/o partner) under water, plyometric workout for basketball etc.
Sixth: Warm Down

- Performed similar to warm up. Some clients, if medical condition allows, like to follow warm down in whirlpool/Jacuzzi for warm gentle stretching
MANAGEMENT

• Eval on land should include those items necessary to know in pool (HR/VC if necessary) teaching self HR, RPE, check phobias/precautions/contraindications, pool tour and instructions etc. Insurance wont pay for a second eval in the pool

• As with all exercise and Plans of Care, goals must be functionally oriented and well documented

• Some insurances may not pay for “aquatic code” specifically. You may need to consider therapeutic exercise code if allowed by carrier.

• Suggest clients be given a list of pool rules, including all precautions and contraindications that they are responsible to acknowledge and sign before initiating pool therapy

• May want to limit how early the client can come to, and how long after, they can stay after aquatic session for dressing etc – may limit to 15-20 minutes pre and post. Can client dress etc independently? Some athletes immediately post op may need assistance, and if wound present, may need protective barrier applied
GETTING CLIENTS BACK TO LAND FUNCTION!

- Aquatic Therapy has been around for a very long time. It can be a terrific rehab tool BUT it is only a tool. The ultimate goal is to return the client to pre-injury function on land.
- Most progress from modalities to modalities prn and pool ex, to pool and land ex, to land only
- Be imaginative, but be safe
- If in an OP/IP clinic- make sure you can get reimbursed for your efforts.
- If in a school setting, make sure part of the total team Plan of Care, and make sure pool is set up for medical care or emergencies.
By knowing basic aquatic principles, and applying your land-based knowledge of rehab, aquatic therapy to athletes can be happy and productive interventions. Thank you.
AQUATIC THEARPY YOUTUBE CLIPS

http://www.youtube.com/watch?v=MKAPEoLWVWo

http://www.youtube.com/watch?v=Z76lS4rmLj0&feature=related

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