SPORTS AQUATIC THERAPY

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SPORTS AQUATIC THERAPY

EWAC MEDICAL
We get you moving

Popular

Aquatic Therapy Challenge
- maximise the potential of the environment
- integrate evidence from all sources

Further develop the evidence and update practice

SPORTS REHABILITATION

- Muscle conditioning
- Flexibility
- Neuromuscular control (balance, proprioception)
- Functional exercise
- Sports skills
- Correction of abnormal biomechanics
- Maintenance of CV fitness

Brukner and Khan 2007

BENEFITS OF WATER AS AN ENVIRONMENT FOR ATHLETES

- Buoyancy
  - Reduced weight bearing/compressive forces/axial load
  - Assisted or supported movement
- Water viscosity, turbulence or drag
  - Resisted or assisted movement
- Warmth
  - Pain relief
  - Increased connective tissue extensibility
- Hydrostatic pressure
  - Compression
  - Physiological load
- Unstable
  - promotes neuromuscular control

OPTIONS FOR SPORTS AQUATIC THERAPY

- Musculoskeletal rehabilitation
- Plyometrics
- Deep water running
- Recovery
- Preventative

SEARCHING FOR THE EVIDENCE

AQUATIC

hydrother$
balneo$
aqua$
aquatic physiotherapy
deep water running
aqua jogging
aqua running

SPORTS

sport
athlete
rehab$
plyometrics

MUSCULOSKELETAL REHABILITATION

- Overload or chronic injuries
  - Tendon
  - Bone
  - Joint
- Acute injuries
  - Sprains and strains
- Rehabilitation
  - Post-reconstruction or surgery
- Evidence based practice
  - specific pathology or presentation in otherwise healthy adults
  - Aquatic or land-based extrapolated to aquatic environment

AQUATIC MUSCULOSKELETAL REHABILITATION OVERVIEW

- Anterior Cruciate Ligament Reconstruction rehabilitation (Tovin, 1994)
- Case studies
  - Lateral ligament rehabilitation (Geigle 2001)
- Strengthening Quadriceps (Poyhonen 2002, Petrick 2001)
- Clinical opinion
  - Prins (1999)
  - Thein and Thein-Brody (1998)

AQUATIC MUSCULOSKELETAL REHABILITATION

EWAC MEDICAL
We get you moving

- Earlier weight bearing and normal movement
- Compression when oedema present
- Integration of trunk control with limb exercise
- Transition to land based exercise
- Return to sport

AQUATIC PLYOMETRICS DEFINITION

- PLYOMETRICS
  - Dynamic stretch-shortening cycle movements (coupling of eccentric and concentric contractions)
  - Potential for injury as intensity of training increases
  - Delayed onset muscular soreness (DOMS)
- AQUATIC PLYOMETRICS
  - Buoyancy and resistance to movement (viscosity/drag) reduces the stretch reflex and the amount of eccentric loading
  - Faster transition time and decreased ground contact time
  - Lower load and less joint compression
  - Less potential for injury

AQUATIC PLYOMETRICS CONTENT

Study	Number of sessions	Pool depth	Total foot contacts
Gulick (2007)	2x/week 6 weeks	Not stated	120-180
Martel (2005)	2x/week 6 weeks	1.12m	Skip/spike/bound 24.4-61m jump 3-4 x 10-30s box jumps 3-15
Miller (2002)	2x/week 8 weeks	Waist depth	80-120
Robinson (2004)	3x/week 8 weeks	4-4.5feet (0.73)	300+

AQUATIC PLYOMETRICS OUTCOMES

- Vertical jump improved in all intervention groups similarly
- Other functional measures – sprint time, stair climb time, isokinetic strength improved in aquatic intervention
- Muscle soreness
  - Less in aquatic group (Robinson 2004)
  - Similar (Miller 2002)
- Comparable outcomes with less risk of joint overload and possibly less post-training soreness

DEEP WATER RUNNING OVERVIEW

- Results influenced by
  - Population
  - Instructions
  - Skill and familiarity
  - Pool temperature
- Technique and Kinematics
- Physiological responses in trained individuals
- Recovery
- Injury prevention

DEEP WATER RUNNING TECHNIQUE

- Action replicates normal running as much as possible
- Floats
  - Free motion of arms and legs
  - Will influence rotation and stability in the vertical position
- Trunk - Forward lean 2-15 degrees
- Legs
  - Hip flexion 60-80 degrees
  - Close to full knee extension when hip in neutral
  - Emphasis on hip extension and leg moving behind the body
  - Some dorsiflexion and plantar flexion
- Arms
  - Elbows bent to 90 degrees
  - Lightly clenched fists

DEEP WATER RUNNING EMG

- Compared with land and water walking
  - Lower soleus and gastroc activity
  - Higher %MVC of biceps femoris (Kaneda et al 2006)

DEEP WATER RUNNING KINEMATICS

- Slower cadence
- Greater hip ROM
- Hip and knee flex and extend together
- No differences in fast and slow intensities
- Lack of stretch-shortening cycle significant
- Consider Shallow Water Running

Kilding et al 2007

- Cross country style more similar than the high knee style

Killgore et al 2006

DEEP WATER RUNNING TECHNIQUE

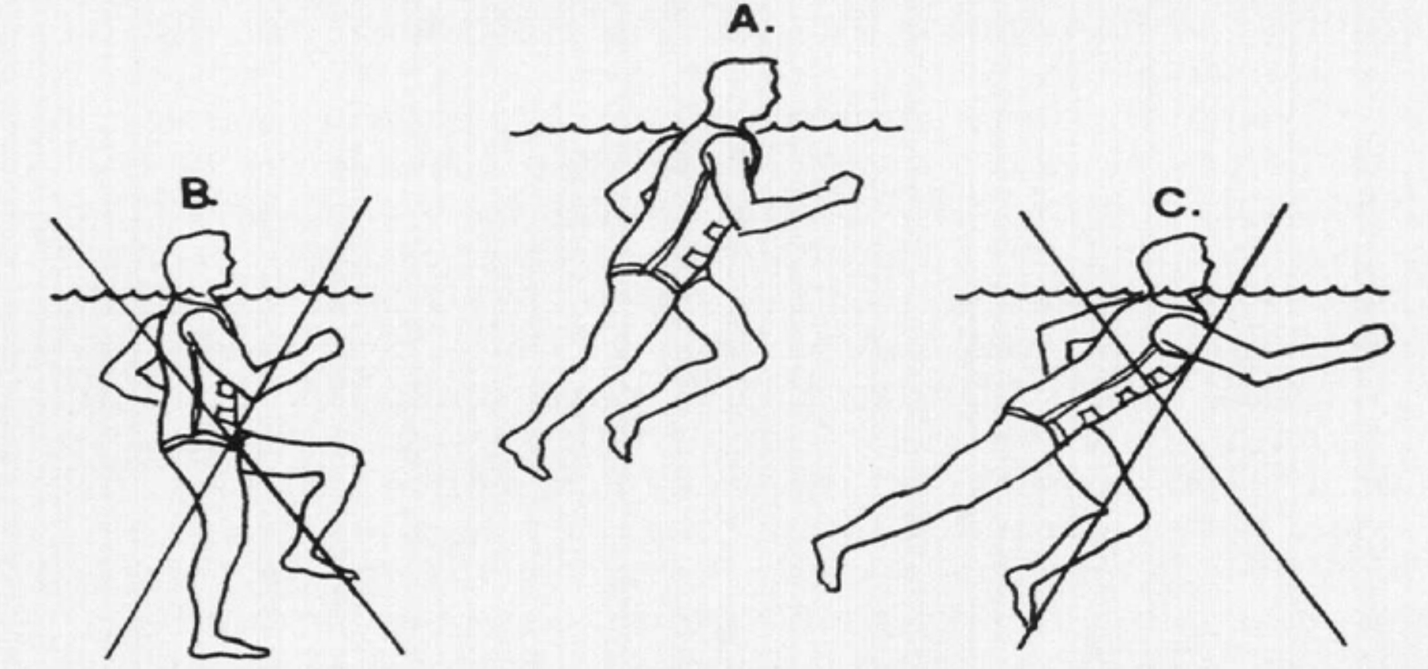


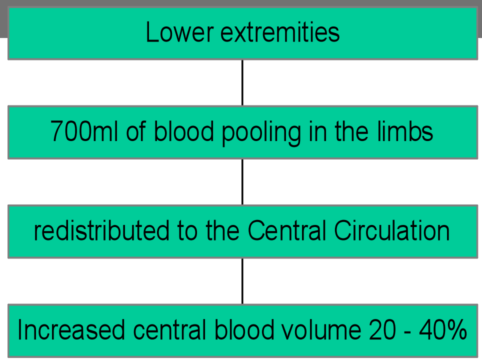
Fig. 2. To perform DWR, lean forward slightly as though running on land (A). Do not attempt to remain stationary (B), and avoid neck extension (C). (Reprinted with permission of Publitec Editions from *Deep Water Exercise for Health and Fitness.*[18])

DEEP WATER RUNNING

DEEP WATER RUNNING INJURY PREVENTION AND REHAB

- DWR - significantly less spinal shrinkage compared with treadmill and shallow water running (Dowzer 1998)
- Introduced along with other measures in nearly 2000 Australian Army recruits (Rudzki 1999)
  - 46.6% reduction n rate of injuries presenting to physiotherapy
  - 41% decrease in medical discharges of male recruits
  - 50% reduction in the cost of bone scans
- Introduced in 181 military recruits with injuries (LL)
  - Program well tolerated
  - Could mimic time spent and frequency of usual runs (Burns 2001),

PHYSIOLOGY OF IMMERSION



- Due to Hydrostatic pressure
- Depth dependent
- Increased stroke volume and cardiac output
- CO = SV x HR
- Reduced heart rate
- Reduced lung volumes

DWR SUBMAX PHYSIOLOGIC RESPONSES

- Similar relationship of HR:VO_2 but depends on skill level (Yamaji 1990)
- At 60% VO_2max no significant difference in HR and RPE was 1.6-1.7 higher in DWR (Killgore 2006)
- For a given submax VO_2 HR on average 10bpm lower in DWR and RPE significantly higher (Svendenhag 1992)

DWR
MAXIMAL PHYSIOLOGIC RESPONSES

Author	VO2 lower in DWR by	HR lower in DWR by
Butts (1991a)	17 % Women	18bpm Women
Butts (1991b)	16% Women \ 10% Men	9bpm Women 10bpm Men
Dowzer (1999)	24.7% Men	23bpm Men
Svendenhag and Seger (1992)	12.2% Men	16bpm.
Town and Bradley (1991)	26.5% mixed	26bpm

DWR MAINTAINING CV CONDITIONING

Study	Number of weeks	Non significant change in run performance	Non significant change in VO2 max
Bushman (1997)	4	√ 5 km	√
Eyestone (1993)	6	√ 2 mile	√
Gatti (1979)	3	N/A	√
Hertler (1992)	4	N/A	√
McKenzie and McLuckie (1991)	3	N/A	√
Wilber et al (1996)	6	√ Treadmill run to exhaustion	√

RPE and CADENCE VALUES MODIFIED BRENNAN SCALE DISTANCE RUNNERS

RPE		CPM	Land Equiv
Very Light	1.0	<55	Brisk walk
	1.5	55-59	
Light	2.0	60-64	Easy jog
	2.5	65-69	
Somewhat Hard	3.0	70-74	Brisk run
	3.5	75-79	
Hard	4.0	80-84	5k/10k pace
	4.5	85-89	
Very Hard	5.0	>90	Short track intervals

RPE and CADENCE VALUES MODIFIED BRENNAN SCALE SPRINTERS

RPE		CPM	Land Equiv
Very Light	1.0	<74	>800m
	1.5	75-79	
Light	2.0	80-84	600-800m
	2.5	85-89	
Somewhat Hard	3.0	90-94	400-600m
	3.5	95-99	
Hard	4.0	100-104	200-400m
	4.5	105-109	
Very Hard	5.0	>110	50-200m

DEEP WATER RUNNING MODIFIED WILDER GRADED EXERCISE TEST

- 30 minutes long
- Each two minutes measure HR and RPE
- At 4 minutes cadence of 48
- At 6 min cadence of 66
- At 26 min cadence of 104
- Warm down
- Then use this information to help design training session

RECOVERY

RECOVERY OVERVIEW

- Recovery after exercise includes
  - Nutrition (carbohydrate replenishment/ protein / supplementation)
  - Fluid replenishment
  - Stress management
  - Sleep
  - Management of DOMS
- Early stages of investigation

RECOVERY (DOMS)

- Post exercise (14 minutes 1x/day for 3 days after exercise)
  - cold water immersion (CWI) 15 degrees
  - hot water immersion (HWI) 38 degrees
  - Contrast water therapy (CWT) 1 min each 7 cycles
- Squat jump performance and isometric force recovery were significantly enhanced CWT/CWI
- Isometric force recovery was greater following HWI
- Pain improved following CWT
- Overall, CWI and CWT were found to be effective in reducing the physiological and functional deficits associated with DOMS

(Vaile et al 2007)

RECOVERY

- 12 RCTs in contrast therapy but insufficient evidence in efficacy
- Combination of active exercise whilst immersed in hot and then cold whirlpools may well lead to enhanced (Wing et al 2008)

DEEP WATER RUNNING RECOVERY

- No weight bearing or ground impact force
- 30 min for 3 days post plyometric exercise improved muscle strength and perceived soreness (Reilly, Cable, & Dowzer, 2002)

PREVENTATIVE SPORTS AQUATIC THERAPY OVERVIEW

- No publications
- Aquatic environment and neuromuscular control
  - Repeated extension-flexion resulted in early reduction of agonist activity concurrently with high levels of antagonist activity (Poyhonen et al 2004)
  - Unknown postural and stabilising mechanisms in water
  - Low load, high attention

DEVELOPING THE EVIDENCE: WATER POLO AND FOOTBALL

- Understand the sport
  - Load
  - Movement
  - Injury
- Measure and collect quantitative and qualitative data
  - Water Polo pilot trial (Heywood and Webster 2008)
  - Australian Rules Football
- Update practice and continue to assess

WATER POLO

- Highly demanding, multiple skills
- Control of throwing, trunk position and kicking may lead to injury
  - No firm base of support
  - Significant rotational forces with respect to Lumbar spine

(Brooks 1999)

WATER POLO

- Few in water tests proposed for assessment in water polo (Smith 1998)
- Limited carryover between land based rehabilitation
  - Specific training and carryover from land training is not achievable related to biomechanical and EMG comparisons in swimming (Clarys 1985)

PILOT STUDY

- Describe methods of assessing core stability in water
- Determine the effect of back, hip or groin pain on these measures (Heywood and Webster 2008)

METHODOLOGY

- Subjects
  - Victorian Women's Water polo squad
- Recruitment / Testing
  - Pre-season training sessions
- Baseline data
  - Age, time in the sport, training, injuries

WATER BASED ASSESSMENT

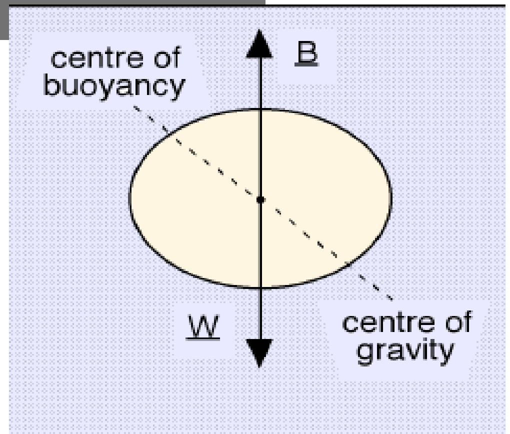
- Vertical jump

WATER BASED ASSESSMENT

- Tethered ‘eggbeater’ kick
  - Maximum distance
  - Endurance

WATER-BASED ASSESSMENT

- Body balance and rotation control
  - Supine
  - Prone



- Alignment of the opposing forces of gravity (COG) and buoyancy (COB)
- COB Centre of buoyancy = centre of the volume of water displaced

ROTATION CONTROL AND METACENTRE

- Methodology
  - Instructed to remove right wrist from water
  - COB moves to the left
  - Resultant rotation to the right

RESULTS

Demographic data

Subjects	6
Age (years)	17-25.4 years
Experience in the sport (years)	5-11
Training (hours/ week)	7-9
Injuries (current)	1 – shoulder 1 – groin pain

RESULTS

- Control of metacentre in supine
  - 5 minimal rotation
  - 1 moderate rotation
- Control of metacentre in prone
  - 4 minimal rotation
  - 2 moderate rotation

RESULTS

- Vertical jump
  - 110cm to 125cm
  - Similar to previously published results (Falk et al 2004)
- Tethered “eggbeater” kick maximum
  - 2.8m to 4.1m
  - Mean 3.53m
- Tethered “eggbeater” kick endurance
  - 18.96 sec to 49.28 sec
  - Mean 31.31 sec
- ? Relationship

CONSIDERATIONS
Immersion

- Immersion
  - Central hypervolaemia (Hall et al 1990)
  - Changes in IAP related to hydrostatic pressure
  - + exercise

CONSIDERATIONS
Interaction with respiration

- Interaction and interference between respiration in activation of lumbopelvic stability
  - Diaphragm - feed-forward drive prior to limb movement (phasic and tonic contractions)
  - Postural challenges and ventilatory challenges (Gandevia et al 2002)
  - One may be prioritised (Saunders et al 2004)

FUTURE DIRECTIONS & RESEARCH

- Water measures
  - Reliability and Validity
- Stability
  - Effect of reduced weight bearing on local stabiliser / TrA function
  - Unstable environment - ? superficial muscle activity
  - Interaction of pain and TrA activity in warm water
  - Benefit of functional positions

AUSTRALIAN RULES FOOTBALL

- Kicking, contact tackling, overhead catching (marking), handballing
- 4 quarters of 20-30 minutes (including time-on)
- High intensity with frequent interchange
- Most common injuries
  - Acute hamstring strain
  - Contact injuries (haematomas)
  - Acute knee injury
  - Ankle sprains
  - Chronic groin injury
  - Back pain

AUSTRALIAN FOOTBALL LEAGUE

- 1 game/week for 22 weeks + finals
- 3 skills training sessions/week
- 3 weights sessions/week
- Yoga, pilates, stretching and aquatic sessions
- Players drafted aged 18, average age ~24
- Challenge – control training load, maintain strength through the season, improve core stability

SPORTS INJURY PREVENTION

- Screening
  - Neuromuscular
  - Past history of injury
- Management of training and playing load
- Sports specific and Individual injury prevention
  - Maintaining flexibility
  - Improving control and stability (trunk/core/ lumbopelvic)

AQUATIC REHABILITATION IN SPORT

- Be confident with your skills as an Aquatic Therapist
- High level in participation doesn’t always equal high function
- Be clear about the aims
- Measure the outcomes

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