Spine Rehabilitation and Core Strengthening in the Aquatic Environment

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Abstract

Increasing core muscle strength and function forms the basis of many rehabilitation and conditioning programs, whether the focus is on the ankle, knee, hip, spine or shoulder. The core provides a stable base upon which the limbs and spine produce efficient and coordinated movement. A poorly functioning base can lead to a multitude of problems whether acutely or cumulatively over time. While core muscle activities on land can be robust in producing results, many individuals are unable to effectively train the core due to a variety of factors. The pool provides an alternative environment with numerous opportunities for improving core muscle strength and function. Aquatic activities can improve core function to a level where the client can transition to land, or it can be an alternative training site for those desiring a break from land-based activities. This presentation will discuss a continuum of training activities for the core muscles. Correct exercise performance, as well as examples of modifications for pathology will be discussed. Case examples will serve to demonstrate implementation and integration.
Aquatic Therapy: Spine Rehab and Core Strengthening

Objectives

- Understand fundamentals of spine structure and related biomechanics
- Understand interdependence of hip, pelvis and lumbar spine
- Describe how core muscles are activated with various exercises
- Design an exercise program to strengthen core for persons of varying abilities

Outline

- Introduction
- Anatomy/mechanics
- Exercise examples
- Precautions
- Conclusions
Who benefits?
- Postural dysfunction
- Mechanical pain
- C, T, L
- S/p surgery
- Sprain, strain
- DDD, DJD
- Spondylolisthesis
- Fracture, osteoporosis

Who?
- People who need:
  - Buoyancy
  - unloads spine
  - decreases loads across joints
- Assistance
  - allows weaker muscles to move limbs
- Gait assistance
  - Gait retraining in ms/nm conditions
  - Early weightbearing

Why?
- Relief of WB
- Unloading spinal joints
- Ease of movement
- Normalize movements
- Normalize gait
- Relaxation
Evidence: Core Strength

- Decreased core strength:
  - Risk factor for LE injuries in sports
  - Assoc. w/ low back pain
- Trunk ms activity occurs prior to LE, suggesting that this activity stiffens spine to provide a solid base of support for the LEs

Evidence: LBP

- Recent systematic review found evidence to suggest that therapeutic aquatic exercise potentially beneficial in the treatment of LBP

Evidence: LBP

- Recent RCT in CLBP found that aquatic therapy produced sig greater improvements in many functional measures than land-based
Rationale

- Many people unable to assume positions necessary for exercise on land
- Initiate rehab sooner
- Prevent secondary problems
- Functional positions

Anatomy

- Cervical and lumbar: convex anteriorly
- Thoracic and sacral: convex posteriorly

Anatomy

- Intervertebral disc
- Facet joints
- Transverse processes
- Spinous processes

Basics of the Lumbar Spine
Biomechanics

- Lumbar spine:
  - IVD and vertebral bodies are primary load bearing structures
  - Facet joints carry small loads

As IVD fails, disc height is lost and facet joints increase WB loads
Facet joints loaded in extension and rotation; avoid in facet disease

Trunk flexion: shifts loads away from facet joints to posterior ligaments & IVD
Slight flexion is preferred posture for those with facet disease
But too much flexion increases pain!
Biomechanics

- IVD failure
- Bulging or herniated discs can place pressure on nerve roots
- Disc collapse increases facet pressure & DDD

Mechanics application

- Flexion increases anterior compression and opens posteriorly, decreasing facet compression, but increases posterior pressure

Mechanics application

- Lumbar extension: compresses facet joints; potentially compresses disc herniation, but used to treat herniation in post acute phases
Mechanics application

- Rotation: loads facet joints, especially in neutral or extension
- Rotation accomplished at hips or higher in spine

So should you do rotation exercises?

As with most things in life: "it depends"

Rotation

- Important in most aspects of function

What about hip extension exercises?

Normal = 15 degrees

Over 15 degrees is spine
Leg lifts backwards

- Watch hip extension ROM
- Anything beyond 15 degrees (normal) is coming from spinal extension
- Closing/compressing facets

Avoid pelvic rocking A to P during leg lifting

Keep hip ext ROM small in upright standing
Spine/Core Training & Mobility

- Why is mobility important?
- What mobility should I emphasize?

Importance of Mobility

- The body is designed to move
- Trunk, hip and pelvis must rotate for normal movement, esp. gait
- If the spine lacks sufficient movement for any reason, it must be made up elsewhere
- Therefore “steal” motion from adjacent joints

Mobility activities

- Directed at adjacent joints
- Combination of static and/or dynamic
- Combine with awareness of posture/ms activity
Buoyant equipment can be placed anywhere along limb to adjust the amount of stretch.
Knee lift with or without trunk rotation

Walking with an exaggerated stride can enhance dynamic mobility.
Core Strength

- The neuromuscular ability to control the lumbopelvic region and protect the spine from injury.
- Requires strength, power & endurance of superficial & deep muscles.

Aquatic Stabilization Ex

- Rationale: spine is partially unweighted, allowing movement with less compressive force.
- Torque w/ less pain.

Aquatic Stabilization Ex

- Arm movements create turbulence that must be resisted by core.
  - AP
  - Lateral
  - Rotational
Aquatic Stabilization Ex

- Bilateral shoulder flex/ext
  - Creates AP sway, shorter lever
  - Can shorten even further by performing elbow flex/ext
- Horizontal ab/ad
  - Creates AP sway, longer lever

Aquatic Stabilization Ex

- Shoulder abduction
  - Creates lateral sway when performed with a single arm
  - Bilateral is simply a shoulder ex in the absence of resistance
- Reciprocal shoulder flex/ext
  - Creates rotation

Aquatic Stabilization Ex

- Key is to resist the forces generated by holding core still
- Requires nm control and kinesthetic sense of posture first
- Can’t train if you can’t recruit
Progressions

- Depends upon goals
  - Strength
  - NM control
  - Balance
  - Controlled mobility

- Depends upon comorbidities
  - Shoulder problems
  - Trunk mobility

- Increased speed
- Increased surface area
- Narrow base of support
- Asymmetrical
- Eyes closed

Examples....
Adding resistance to AP sway

Wide base to...

Narrow base

Resisted walking with the addition of gloves isometrically or isotonically in a variety of directions
Adding buoyancy-resisted exercises in a variety of patterns to recruit core.

Increasing surface area to increase resistance.

Stabilization occurs on stance limb, as it stabilizes pelvis for moving limb.
Bow & arrow ex with wide base & wide elbows OR narrow base and arms in create different emphasis.
Leg movement on fixed pelvis working bottom up

Supine abs and hip extension

Ab press down

Supine ab curl with fixed legs
Buoyant dumbbell pull down in a variety of postures; use w/ CV training.
Leg movements in a variety of directions keeping pelvis stable

Resistive walking with plow

DW Stabilization sequence
To ensure pelvic control prior to NWB activities.
Higher level activities

- Mimic functional activities
- Hop, stick, direction changes
- Push-pull
- Complex movement patterns
- Lifting
- Advance cardio

Exercise challenges
- Decrease task complexity
- Change exercise location
- Change exercise speed
- Change exercise mode
- Decrease stability of BOS
- Reduce feedback
- Alter the environment
- Alter exercise sequence
- Reduce cognitive control

Continually Expanding Exercise Volume

Add more exercises
Increase resistance
Decrease rest intervals
Increase repetitions
Increase frequency
Add more sets
Decrease resistance
Chronic Pain

- Fibromyalgia
- Chronic LBP
- Chronic fatigue syndrome
- Stenosis/DDD/DJD
- Chronic regional pain syndrome

Pool ideal place to work
- Warmth of water
- Unloading due to buoyancy
- Ease of movement

Considerations
- Avoid overwork
- Short lever
- Decreased surface area
- Side step
- Slow movements
- Relaxation
Considerations

- Find exercises they tolerate
- Balance frontal resistance vs. buoyancy
- Alternate exercises
  - Small muscle group
  - Large muscle group
  - Upper extremity
  - Lower extremity
  - Core
- Only a few reps of each

Considerations

- Stick with exercises tolerated
  - If many, only a few reps of each
  - If only a few, a few reps and more sets
- Increase by increasing total exercise time
- Give frequent rest
  - Walk, relax, unweight, float

Issues

- Avoid overwork
- Start with short sessions
- Gradually increase
- Add resistance last
Precautions

- Overwork
- Effects of WB or frontal resistance
- Compensatory postural stresses

Thanks! Questions?

References

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