25 Cervical Aquatic Therapy Maneuvers
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Objectives
- Link rehabilitation goals with aquatic therapy interventions
- List red flag symptoms or signs requiring referral to physician.
- Describe common postural deviations and muscle firing patterns found in individuals with chronic neck pain.
- Cue client through water exercises to improve posture, increase upper quadrant strength and decrease stress/tension in the cervical muscles.
- Perform manual techniques for the cervical spine to achieve specific rehabilitation goals.

Statistics
- Affects nearly 50% of the population at some time in their lives
- Affects women more than men
- 2nd largest cause of time off work
- Cervical impairments (loss of ROM, decreased strength) have been found in up to 70% of people with headaches

Functional Anatomy
- 2 regions
- Intrinsic and extrinsic muscles
- 37 Joints
- Intervertebral discs = 25% height of c-spine
- Nerve facts
- Ligaments stabilize
- Vertebral artery

Common Pathology
- HNP
- DDD
- DJD
- Facet joint
- Sprain/strain
- Myofacial pain
- Whiplash

Disc Herniation (HNP)
- Various grades
  - Annual fissure
  - Disk bulge
  - Disk protrusion
  - Disk extrusion
  - Disk sequestration
- Avoid movements that involve flexion and rotation of the neck
Degenerative Disc Disease (DDD) vs. Degenerative Joint Disease (DJD)

- **DDD**
  - Disc height
  - Traction spurs
  - 90% of people 60+
    - Sorry Ruth
  - Most common level C5-6

- **DJD**
  - Facet Joint space narrowing
  - Primary complaint is AM stiffness
  - Extension may be limited
  - Occurs in 40 y.o. and up

Degeneration = narrowing

- Avoid compressive forces through the cervical spine
- Avoid extension
- Encourage pain free movement

Facet joint

- Most common cause of chronic neck pain after whiplash
- Meniscoid material entrapment
- Possible cause

Sprain = ligament

- Strain = muscle

- Various causes
  - Poor posture
  - Repetitive trauma/overuse
  - Injury (MVA, fall, sports etc.)

- ROM limited in whatever direction stresses the injured muscle or ligament

- Often strained muscles are tender may or may not be weak
Myelopathy
- Space occupying lesion
- Most likely at C5-6
- Multiple extremity symptoms, clumsiness
- With prolonged compression of the spinal cord long term/ permanent weakness, pain or numbness is possible.
- Avoid extension which closes down space even more.

Myofascial Pain
- Trigger points
- Tenderness and referred pain
- Focus on quality of movement, breathing, pain free movement
- Remind client to stay hydrated, plenty of sleep and decrease stress

Whiplash injury
- Describes the consequences of an acceleration/ deceleration injury
- Extensive microtrauma can occur
- Slow nature of recovery
- Client education is important

Surgery
- Fusion
- Disk replacement
- Discetomy
- Foraminotomy
- Primary concern after surgery is to maintain health of joints above and below the level of surgery

What’s causing my pain?
- It is virtually impossible to know for certain which structures are causing the pain in the cervical spine.
- Chronic pain is even harder to determine exact location.
- We address movement and alignment and base the program around those findings not just a diagnosis

Red Flags
- Vertebral artery compromise
- Drop attacks
- Lip paraesthesia
- Nystagmus
- Spinal cord compression/ compromise
- Multiple extremity symptoms
- Signs of nerve root compression
- Pain, numbness and tingling distally
- Loss of sensation
- Isolated muscle weakness
Common treatment goals for cervical spine dysfunction...

- decrease pain
- reduce muscle tension
- increase mobility
- improve muscle balance
- restore postural awareness
- Decrease neural irritability
- Increase scapular stabilization

Treatments broken down....

- Joint Mobility/ ROM
- Muscle flexibility/ Stretching
- Correction of movement dysfunction
- Postural education
- Breathing/ Muscle tension relaxation/ rib cage mobility
- Neural tension/ mobility
- Scapular stabilization/ strengthening
- Functional integration

Neck Pain: Clinical Practice Guideline

- Impairment Based Categories
  - Neck pain with mobility deficits
  - Neck pain with HA
  - Neck pain with movement coordination impairments
  - Neck pain with radiating pain

CPG Intervention Recommendations

- Stretching exercise (weak evidence)
- Coordination, strengthening and endurance exercise (strong evidence)
- Centralization procedures and exercise (weak evidence)
- Upper quarter and nerve mobilization (moderate evidence)
- Patient education (strong evidence)

Range of Motion

- Normal values (varies with age)
  - Flexion 80-90 degrees
  - Extension 70 degrees
  - Lateral flexion 20-45 degrees
  - Rotation 70-90 degrees

- When assessing ROM watch for compensatory movement.
- Compare ROM land vs. chest deep water

Clinical Pearl

- If cervical ROM (rotation/ side-bend) increases +/- or pain diminishes with upper arm weight supported compared to arms in gravity dependent position excessive pull from cervical muscles such as upper trapezius is suspected.

- In addition it is an indication that aquatic exercise providing buoyancy support of the UE is justified (document ROM and pain both on
Cervical Muscle Function

1. Move head and neck
2. Support and Move shoulder girdle
3. Suspend, fix and elevate the thoracic inlet

Intrinsic vs. Extrinsic

- **Intrinsic**
  - Close to the joints
  - Fine motor control
  - Often weak/overpowered by extrinsic

- **Extrinsic**
  - Further from the joints
  - Create motion
  - Create shear forces

Common Muscle Impairments

- **Long/weak**
  - Intrinsic
    - Longus capitis/colli
    - Semispinalis capitis/cervicis/splenius

- **Short/stiff/dominant**
  - Extrinsic
    - Scalenes
    - SCM
    - Levator scapula
    - Upper trapezius

Intrinsic/ deep neck flexors

- Longus capitis and longus colli
- Function = cervical flexion with sagittal rotation
- Research has linked significant decrease in strength and endurance with chronic headache

Neck exercise- sitting posture with chronic neck pain

58 females with chronic neck pain (37.8 ± 10)
10 control subjects
Pain greater than 3 months (average 7.9 yrs)
2 groups: Craniocervical flexion and generalized strength and endurance neck ex.
6 weeks 1x/wk with PT and 2x/day no more than 10-20 min. per day
### Research findings
- Those with chronic pain demonstrated change in C-S angle across the duration of task consistent with forward head (no change noted in control group)
- Following training the CCF group demonstrated significant decrease in change of c-s angle compared to general training group.
- Both groups had significant decrease in average pain intensity and NDI scores

### Head Nods/ Axial Extension Various Positions
- Supine with assist to learn movement
- Sitting and standing against wall
- Sitting and standing away from wall
- Quadraped
- Prone
- With arm movements

### Strengthening the deep neck flexors
- Pressure Bio-feedback device (Stabilizer™)
- Tongue on roof of mouth, gently nod head watch for substitution
- Carry over to functional positions and other exercise

### Using Feedback
Cranial Cervical Flexion Test
- Activation score = amount of pressure increase achieved and held for 10 seconds
- Performance score
  - Pressure increase mmHg x #times the patient can hold that pressure for 10 seconds.
  - Examples:
    - increase 10 mmHg and hold for 10 seconds for 10 repetitions = 100%
    - Increase 4mmHg and hold for 10 seconds for 10 reps = 40%
  - Watch for substitution by extrinsic muscles

### Testing used in the CPG
- CCF test: ability to initiate and maintain CCF it is a pass/ fail graded test
- Neck flexor endurance: lift head with CCF 1 inch and hold for time (those without pain average 38.95 seconds and those with averaged 24.1 seconds)

### Scalene Muscles
- Neurovascular bundle passes through
- Tight and stiff
- Stretch requires stabilization of the ribs
- Tight abdominals can cause depressed rib cage leading to constant pull on scalene muscles
Scalene Stretch

- Manual by stabilizing the first rib
- Self stretch with a towel
- Encourage breathing with focus on relaxing scalene vs. using as an accessory.

Decreasing pull on Scalenes

- Reduce forward head position
- Increase rib cage mobility.

Sternocleidomastoid (SCM)

- Significant influence on c-s motion but does not directly attach to the cervical spine
- Function = bilaterally flexes c-s, unilaterally rotates to opposite side, laterally flexes same side. Clavicular (lateral) head will extend neck.

Neck Extensors

- Intrinsic extensor muscles often stiff/short or poor performance.
- Function: posterior sagittal rotation and unilateral rotation
  - Semispinalis capitis & cervicis
  - Splenius
  - Suboccipital group

Levator Scapulae

- Transverse processes of C1-4 to medial superior border of scapula
- Function = elevates and downwardly rotates scapula, rotates and side-bend neck to same side.
Upper Trapezius

- Occiput, nuchae, thoracic spinous processes to spine of scapula and lateral 1/3 of clavicle.
- Extends head on c-s, rotates away and side-bends towards.
- Creates posterior shear that needs to be counterbalanced by longus colli and capitis.

Ask where they feel the stretch!

- Desired sensation in gentle pulling on side you are stretching
- Undesired is compression/ pinching pain on opposite side of muscle stretching.
- Be sure to start with axial extension.

When shoulder motion induces cervical motion ...

- Single arm shoulder flexion
  - Rotation toward shoulder flexing = levator scapulae stiffness
  - Rotation opposite shoulder flexing = upper trapezius stiffness
- Bilateral shoulder flexion
  - Extension of C-S = levator scapulae stiffness

Ideal Alignment

- Head balanced over shoulders
- Cervical lordosis, thoracic has outward curve
- Shoulders level
- Scapula approximately 3 inches from midline and sit between T2 and T7

Why is it important?

- Deviations in alignment and movement patterns contribute to micro-trauma which in turn can result in macro-trauma.
- Prolonged and repetitive deviations alter the proprioception, muscle length and balance. Essentially the person is unaware of the faulty alignment or movement pattern.

Influences on alignment

- Intrinsic muscles
- Shoulder girdle muscles that attach to cervical spine
  - Rhomboid minor
  - Upper trapezius
  - Levator scapulae
- Alignment of the thoracic spine
## Forward Head
- Upper cervical spine in extension
- Lower cervical spine in flexion
- Weakness intrinsic neck muscles
- Overuse/ dominant/ stiff scalenes, SCM, levator scapula and upper trapezius
- This anterior translation causes the c-s to be in extension in turn limiting extension ROM

## Shoulder Girdle Alignment
- Alignment of the shoulder girdle is often the key to neck pain
- Depressed forward shoulder often associated with tight pectorals, and latissimus dorsi
- Scapular depression/ abduction = UT and levator to be lengthened, downward pull exerts compressive force on the facets, narrows the intervertebral foramen, traction on the brachial plexus.

## Latissimus Dorsi flexibility
- Observe c-s spine, rib cage and shoulders for compensation.
- Can be objectively measured by degrees of shoulder flexion to document progress.

## Treatment Strategies
- Therapeutic exercise shown to decrease pain, and improved function
  - ↓ compression and shear forces from UT and levator
  - ↓ compression on neck from scalenes
  - ↓ resistance/ pull from lats and pecs when shoulders are flexed
  - ↑ scapula support from middle, lower trapezius and serratus anterior (SA)
    - Upper fibers of SA can inhibit lower and mid fibers
  - ↑ intrinsic muscle control

## Whole body can influence posture and alignment on land...

## and in the Pool!
### Thoracic Spine

The link between cervical spine and lumbar spine.

Connection of UE to spine

All or nothing posture a challenge to gain thoracic extension without excessive lumbar extension and/or slight posterior tilt of pelvis without corresponding trunk flexion.

### Exercise Focus

- Posture and alignment of whole spine and scapulae
- Upper quadrant balanced strength
- Correct movement patterns
- Pain free range of motion

### Basic alignment exercise

- Sit against wall pull abdominals in
- Shoulders back
- Head back but eyes level: head nods
- Maintain position flex shoulders
- May need to start supine

### Don’t forget general spine stabilization exercise.

- Transverse abdominus
- Pelvis in neutral
- Rib cage alignment and placement
- Body awareness
- Watch cervical spine with supine lower abdominal exercise.

### Verbal Cues

- Eyes level
- Shoulders down and relaxed
- Sternum/ chest lifted
- Lengthen the back of your neck
- Nod chin slightly
- Keep collar bones wide

### How does aquatic therapy help the Upper Quadrant?

- Although little evidence is provided by solid research the general consensus among experts is aquatic exercise:
  - Allows for early activation of ROM
  - Increases strength, joint mobility and proprioception.
  - Decreases pain
  - Decreases risk of future injury
  - Provides general rehab/ whole body
Shoulder Muscle Activation Aquatic and Dry Land Comparison (Kelly et al. 2000)

- RCT N=6 healthy males 21-27 y.o.
- Muscle activation of supraspinatus, infraspinatus, subscapularis, anterior, posterior and middle deltoid. During shoulder elevation (in scaption)
- $30^\circ$/sec and $45^\circ$/sec test speeds were significantly less when performed in the water vs. on land.
- At $90^\circ$/sec movement in water caused greater activation of muscles.

In addition to exercise and education:
- Muscle relaxation
- Stress management
- Trigger point and myofascial release
- Aquatic treatments include
  - Ai Chi
  - Aquatic Integration
  - Applied Manual techniques
  - Therapeutic exercise capturing the unique properties of water

Ai Chi

- Ai chi is a technique of active relaxation related to T’ai Chi and Chi Gong performed in the water.
- Performing simple and slow movements, progressing to weight shifting with arm movements and narrowing base of support having a positive effect on balance and coordination.
- Movements are combined with deep breathing

Aquatic Integrative

- **Aquatic Integration (AI)** is a new approach to hydrotherapy which combines eastern meridian and point work with myofascial release, proprioceptive neuromuscular facilitation and breathwork. AI is highly effective in restoring sensory perception and motor control as well as increasing range of motion and reducing muscular spasticity and has proven a profoundly effective tool in pain management.

- [http://www.aquaticintegration.com/frame_index](http://www.aquaticintegration.com/frame_index)

Manual Therapy Techniques

- Buoyancy supported patient
- Must consider therapist position patient position and manual contacts
- Often stretching and joint mobilization is easier with more precise control on land.
- Caution when in pool with others as unexpected turbulence can change patient and therapists positions.

Accepting Supine

- Trust
- Adequate support
- Collar choice
- Ear plugs needed?
Challenges with Supine Activity

- Ear problems/ hearing aids
- Vertigo
- Sensitivity to light
- Fear
- Cervical spine issues (decreased tolerance to cervical collar)
- Wet hair

Collar Choice

- Keeping head and ears out of water does not allow for ideal alignment (keeps patient in too much flexion)
- Softer collars can sometimes cause too much extension.

Develop a flow

- When performing manual techniques and moving the patient simultaneously ensure enough room to continue to move without abrupt stops and starts.
- Therapist needs adequate stabilization: if water is too deep causing therapist to lose balance and control use weights or dive belt to add to stability.

Neural Glides

- Nervous system is a continuum that allows a differentiation between neural and non neural tissues.
- Two types
  - Sliders: flossing movement
  - Tensioners: more vigorous technique “pulls from both ends”

Median Nerve

- CTS, post Colles’ fracture, C5-6 nerve root
- “Push the plate away”
- “Look at the watch”
- “Buzzing bee”
- “Hand press and slide”
- Noodle horizontal abduction with head rotation

Pool application example
Ulnar Nerve

- Common entrapment Guynon’s canal and cubital tunnel
- “Don’t listen”
- “Smoking”

Radial Nerve

- Common entrapments: DeQuervain’s, supinator muscle (tennis elbow), post humeral fracture pain, C5-6 nerve root.
- “pouring water”
- “figure 8 pendulum”
- “look at your hand behind your elbow”

Equipment Recommendations

- Adjustable surface area to meet the needs of the individual
- Weight should be light to minimize the inertial forces encountered in changing the velocity of paddle movement
- Handle should have a relatively large circumference without digital profiling
- Aquatic equipment can increase the resistance and make rehab more sport specific.
- Always understand how a piece of equipment will change an exercise.

Example: Hydro-tone bell

- Hydro-tone bell orientation and velocity of movement have considerable effect on force production.
- 50% more force produced with bell is positioned at 45° angle compared to 0° when velocity was 152 cm/sec
- With slow velocity 31cm/sec was close to equal in both positions.

Resistance from buoyancy more evenly distributed

Precautions with pool exercise

- Watch head position many will use to control metacentic effect
- Keep hands relaxed when using short bars, avoid death grip and excessive shoulder tension
- Avoid looking up at instructor for prolonged periods
- If patient is chilled neck muscles will tighten
Whole picture

- Check size and type of pillow and sleeping position
- Note body language
- Home and work activities/posture
- Bra and bathing suit straps
- Re-education
- Whole spine

Applying maneuvers to the categories of dysfunction discussed in the clinical practice guidelines

BACK TO WHAT WE LEARNED IN THE POOL...

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<th>Neck Pain with Mobility Deficits</th>
<th>Neck Pain with HA</th>
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<tbody>
<tr>
<td>Younger (&lt;50 years old)</td>
<td>Unilateral HA associated with neck/sub-occipital area and aggravated by neck movements or postures</td>
</tr>
<tr>
<td>Acute neck pain (&lt;12 weeks)</td>
<td>HA produced/aggravated with provocation to ipsilateral posterior cervical myofascia and joints</td>
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<tr>
<td>Symptoms isolated to CS</td>
<td>Decreased ROM</td>
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<tr>
<td>Restricted ROM</td>
<td>Decreased segmental mobility</td>
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What maneuvers do you think would be best to address these problems?

<table>
<thead>
<tr>
<th>Neck Pain with Movement Coordination Impairments</th>
<th>Neck Pain with Radiating Pain</th>
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<tbody>
<tr>
<td>Longstanding neck pain (&gt;12 weeks)</td>
<td>UE symptoms: radicular or referred, produced/aggravated by Spurling’s test, ULTT, and decreased by cervical distraction</td>
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<tr>
<td>Abnormal CCF test and deep flexor endurance test</td>
<td>Decreased cervical spine rotation (&lt;60%) toward involved side</td>
</tr>
<tr>
<td>Coordination, strength, endurance deficits of neck, upper quadrant muscles</td>
<td>Signs of nerve root compression</td>
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<tr>
<td>Flexibility deficits of upper quadrant</td>
<td>Success with decreased UE symptoms with initial examination and intervention procedures</td>
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<td>Ergonomic inefficiencies with performing repetitive activities</td>
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