Week 2: Posture and Core Stability

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Objectives:

- Learn and practice common postural exercises.
- Learn about “Text Neck” and proper posture when using a phone.
- Learn and practice proper lifting mechanics.
- Practice and gain knowledge on diaphragmatic breathing.
- Learn about flat feet and plantar fasciitis causes and treatments.
Posture

Relationship of the trunk and limbs to one another in an upright position.

Good posture is considered to be “ergonomically advantageous while standing, mechanically effective while moving and supportive for function of internal organs”, Czaprowski et al. (2018).

“Good posture is that state of muscular and skeletal balance which protects the supporting structures of the body against the injury or progressive deformity, irrespective of the altitude (erect, lying, squatting or stooping) in which these structures are working or resting. Under such conditions, the muscles will function most efficiently, and the optimum positions are afforded for the thoracic and abdominal organs”, Kendall et al. (2005).
Describing Good Posture a.k.a. Sagittal Alignment

**For clinicians:** Line from the external auditory meatus runs through the acromion, lumbar vertebral bodies, slightly posterior to the hip joint anterior to the knee joint and at or slightly in front of the lateral malleolus.

**For the patient:** Ears over shoulders, and in line with the hips, and ankles. Pull your shoulder blades down and back. *See Handout.*
Improve Your Posture!

Poor posture can lead to injury! The following is a quick guide on how to prevent injury and protect the spine!

Do I have incorrect posture?

Few will have “perfect” posture. Use the picture to the right to see what you need to correct!

What are the effects on my body with poor posture?

Here is what the research shows:
- Pain can arise from sore joints and muscles
- Weakening or tightening of muscles
- Increased load on the back bones leading to early degeneration
- Increased stress to nerves and blood vessels
- Tension headaches
- Vertebral fracture is an increased risk for those with osteoporosis if poor posture persists
- Degeneration of ligaments holding the spine in place
- Shoulder injury if the shoulders are rounded
- Breathing may be more difficult
- Vertebral discs will be under more pressure

Follow these easy steps!

1. Stand up tall by straightening your back
2. Tuck your chin so your ears are over your shoulders
3. Pull your shoulder blades back together and downward
4. Tighten your core by drawing your belly button in toward your stomach.
5. Try to remind yourself as often as possible!
Effects of “Poor Posture”

Inactive postural stabilizers $\rightarrow$ hypoactivity reaction and muscular weakness

Hyperactive mobilizing muscles and decreased flexibility $\rightarrow$ Pathological chain of reaction
Postural Stabilization Muscles

Cervical:

- Longus Colli
- Longus Capitis
- Multifidus Cervicis
- Levator Scapulae

Thoracic:

- Multifidus
- Erector Spinae
- Rhomboids
- Trapezius
Cervical Lordosis (Forward Head Posture)

**Effects:**

- Contraction of cervical, suboccipital and shoulder musculature
- Increased load on the cervical vertebrae and soft tissue
- Increased stress to neuronal and vascular structures
- Tension headache
- Upper crossed-syndrome
- Static Balance Control

**How to Fix:**

- Strengthen deep neck flexors
- Isometric extension
- Endurance exercises (Prone chin tucks)
- Stretching of anterior and posterior structures
- Chest stretches
- McKenzie and Kendall Methods
Research: Forward Head Posture

Lee et. al, (2017) found: “No significant differences between the [McKenzie Method, Kendall exercises or self- stretch technique], but all groups showed significant improvement of the craniovertebral angle.

Hansraj et. al. (2014)
Thoracic Kyphosis

Effects:

- Vertebral fracture due to anterior body mass shift
- IV disc degeneration due to increased compressive loading
- Loss of spinal muscle strength
- Degeneration of IV ligaments
- FHP
- Impingement syndrome
- Decreased breathing efficiency
- Upper crossed syndrome

How to Fix:

- Thoracic extension exercises
- Scapular retraction and depression exercises
- Extension over a foam roller
- Cervical retraction with or without resistance
- McConnell and Kinesiotaping methods
- Posture corrector brace
- Postural Education
Research: Thoracic Kyphosis

Gokhan et. al. (2017) found that: a “corrective exercise program can decrease the kyphotic angle and pain while increasing function” in those with thoracic pathologies.”

These exercises include:

- PNF stretches for the chest
- Strengthening of the abdominals
  - Stomach crunch with legs raised
  - Side plank
  - Plank
  - Bridging
Anterior thoracic posture increases thoracolumbar disc loading

Harrison et. al. (2005)
Research: Thoracic Kyphosis

Brzek et. al. (2017), found that “differences in the weight of school bags after one school year have influenced changes in body posture abnormalities, especially in rotation.”

- Increase in torso rotation exceeding norms in 35% of girls and 61% of boys due to asymmetric strap length
- Increase in kyphosis angle in 49% of girls and 37% of girls due to school bag being placed too high on the spine
- “A great deal of parental control is required.”
- Appropriate weight should be no more than 10-15% of their weight
Activity

Practice looking at posture with the plumb line
“In trained athletes, the core musculature is activated through a feed-forward mechanism shortly before movements of the upper and lower extremities to act as a foundation upon which skilled movements can be performed.”

Abdelraouf et. al., (2016)
Categorization of Lumbar (Core) Musculature
Moon et. al. (2013)

Core Stabilizers:

- Transversus abdominis
- Lumbar Multifidus
- Internal Obliques

Prime Movers of Flexion and Extension

- Rectus Abdominis
- Erector Spinae
Loss of Lordosis and Core Instability

- Abdelraouf et. al. (2016) suggested that: “the faulty movement patterns characterized by early dominant activation of trunk muscles and delayed activation of synergistic muscles can cause instability and excessive joint motion with increased risks for dysfunction and pain.”
- Cho et. al. (2015) found that core strengthening can increase the lumbar lordotic angle and decrease ODI scores.
- Chun et. al. (2017), found that “patients with LBP had a smaller LLA.”
Intervertebral Pressure in Different Positions

Key Points

- A relaxed “slouched” position not only reduced muscle activity but IV disc pressure as well.
- Rehydration during sleep increases IV disc pressure after 7 hours in the lying position to 240% of pressure before bed.

Limitations: one subject
Spine Preservation During Lifting


Key Points:
- Reduced net moments, muscle forces and internal spinal loads
- Larger forces with stoop due to large “rotations” of thorax, lumbar and pelvis
- Limitations: Only a sagittal plane model
Effect of knee position on hip and knee torques during the barbell squat.  
Fry et. al, (2003)

Key Points:

- If knee issues exist (ie. chondromalacia, patellar tracking, ligament damage), restriction is suggested.
- Knees restriction places more stress on hip and low back and may require that the knees move past the toes.
- “Exercise technique guidelines should not be based primarily on force characteristics for only 1 involved joint (e.g., knees) while ignoring other anatomical areas (e.g., hips and low back).”

Table 1. Hip and knee torques for both squat conditions (mean ± SD).

<table>
<thead>
<tr>
<th>Variable</th>
<th>Unrestricted</th>
<th>Restricted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knee torque (N·m)</td>
<td>150.1 ± 50.8</td>
<td>117.3 ± 34.2*</td>
</tr>
<tr>
<td>Hip torque (N·m)</td>
<td>28.2 ± 65.0**</td>
<td>302.7 ± 71.2**,**</td>
</tr>
</tbody>
</table>

* Different from unrestricted squats ($p < 0.05$).
** Different from knee torque ($p < 0.05$).
Hip Hinge

The hip hinge (or deadlift) is a lifting pattern that puts stress on the LEs and preserves the back.
How to Teach the Hip Hinge

1. Activate transverse abdominis through the whole motion
2. Retract and depress the scapula
3. Chin tuck
4. Contract the glutes and hamstrings
5. Keeping a slight angle at the tibia, push the hips posterior, not down.
6. You should feel a slight stretch on the hamstrings
Or this happens:
Activity

Practice performing the hip hinge
Effect if Lumbar Stabilization and Dynamic Lumbar Strengthening Exercises in Patients with Chronic Low Back Pain

“Compared with the baseline, lumbar extension strength at all angles improved significantly in both groups after 8 weeks. The improvements were significantly greater in the lumbar stabilization exercise group at 0° and 12° of lumbar flexion.”

- Decreased VAS Score in both groups
- Improved ODQ Scores in only the stabilization group.
Effect of Lumbar Stabilization and Dynamic Lumbar Strengthening Exercises in Patients with Chronic Low Back Pain

- 16 Exercises aimed to strengthen the lumbar stabilization muscles:
  - Transverse Abdominis
  - Lumbar Multifidus
  - Internal Obliques

  All exercises began with TA activation and concentrated breathing

- 14 Exercises which aimed to strengthen the erector spinae and rectus abdominis
Diaphragmatic Breathing

- A sheet of muscle that separates the THORACIC and ABDOMINAL cavities
- Thoracic cavity contains heart and lungs
- Abdominal cavity contains digestive tract and other organs
- It is the primary breathing muscle!
Diaphragmatic Breathing

- Inhalation is an ACTIVE process, we are using our muscles
- Exhalation is a PASSIVE process, we exhale just through the elastic recoil of the lungs and rib cage
- During contraction, the diaphragm FLATTENS and pulls the ribcage UP and OUT
  - This creates negative air pressure within the lungs, like a vacuum and air rushes in
- During relaxation, the diaphragm returns to its dome shape and the rib cage recoils back down
Diaphragmatic Breathing

Primary Muscles

- Diaphragm, External Intercostals (inhaling), abdominals (only on forceful exhale)

Accessory Muscles

- Sternocleidomastoid, Scalenes, Pec Minor
Accessory Muscle Use

If you do not actively recruit the diaphragm well, you rely on your neck muscles to pull the ribcage up.
How to Diaphragmatic Breathe

Breathe through your belly

- Take a breath keeping your chest stationary and letting your abdomen rise and fall
- Also practice by placing both hands on your abdomen and try to separate your hands using just your belly

Crocodile Breathing

- https://www.youtube.com/watch?v=8AL2DyYpBFc&ab_channel=TangeloManualTherapy%2BMovement%28formerlyKinetic%29
Activity

Practice diaphragmatic breathing
Pes Planus or “Flat Feet”

- A normal foot variation where the soles of the feet touch the floor in a standing position

- Causes:
  - Hereditary
  - Post-injury
  - Wear and tear from normal aging process
  - Muscle tightness
  - Ligament laxity

- May cause knee and ankle problems due to malalignment

- Most people don’t experience any symptoms, but you may experience:
  - Pain along the heel or arch area
  - Swelling along the inside of the ankle
  - Pain which worsens with activity
More on Flat Feet

- **Risk Factors:**
  - Obesity
  - Injury to the foot or ankle
  - RA
  - Aging
  - Diabetes

- **Treatment**
  - Usually no need for treatment if no pain
  - Orthotics
  - Supportive shoes
  - Physical therapy - stretching, joint mobs, strengthening, taping
Plantar Fasciitis

● Inflammation of the plantar fascia AKA the connective tissue that connects your heel to your toes

● Causes:
  ○ Chronic irritation from pes planus or pes cavus
  ○ Acute injury

● Risk factors
  ○ Typically occurs in people 40+ years of age who work most of the day on their feet
  ○ Runners
  ○ Obesity
  ○ Poor footwear
More on Plantar Fasciitis

● Symptoms:
  ○ Pain at the mid arch or medial heel
  ○ Pain when getting out of bed in the morning
  ○ Pain with extending the toes
  ○ Pain with dorsiflexing the ankles

● Treatment
  ○ Rest, ice, NSAIDS, night splints, orthotics, stretching, supportive shoes, taping, cortisone injections, massage, strengthen weak muscles!
Questions?
References and Resources