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**Foundations of Strength Testing:**  
Techniques for Cervical Spine

Wednesday October 30th, 2024

## Introductions:



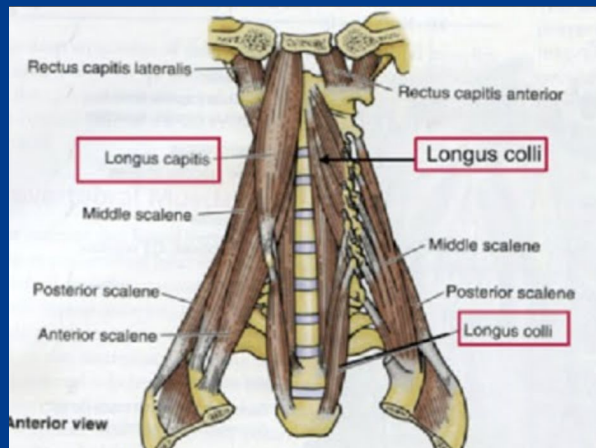
Dr. Daniel G. Stewart,  
PT, DPT

# Agenda

- Introduction to Cervical Strength Testing: Flexion, Extension, Left and Right Side bend, Left and Right Rotation
- Overview of how to test the Cervical Spine
  - Flexion
  - Extension
  - Left and Right Side bend
  - Left and Right Rotation
- Case Study- Analyzing the data
- Case Study- Possible rehab interventions

## Cervical Flexion

# Cervical Flexion



Muscle	Origin	Insertion	Innervation
Rectus Capitis Anterior	Anterior tubercles of transverse process of atlas	Occipital bone anterior to the foramen magnum	Ventral rami of C1, C2
Rectus Capitis Lateralis	Superior surface of transverse process of atlas	Interior surface of jugular process of occipital bone	Ventral rami of C1, C2
Longus Capitis	Anterior tubercles of transverse processes of C3-C6	Basilar process of occipital bone	Ventral rami of C1, C2, C3
Longus Colli	Superior oblique - Anterior tubercles of the transverse processes of C3, C4, C5, Medial - Vertebral bodies of C5-T3, Inferior oblique - Vertebral bodies of T1, T2, T3	Superior oblique - Anterior arch of atlas, Medial - Vertebral bodies of C2, C3, C4, Inferior oblique - Anterior tubercles of transverse processes of C5, C6	Ventral rami of C2-C6

# Cervical Flexion



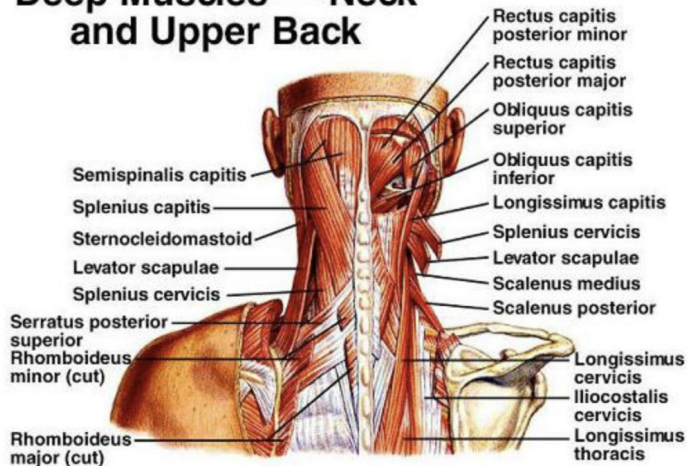
## Supine

- Can test in Standing, Sitting, Supine, and Sidelying
- Testing at different angles: **Neutral, Mid range, End Range**, etc
- **Usually without a strap**

# Cervical Extension

# Cervical Extension

## Deep Muscles — Neck and Upper Back



Muscle	Origin	Insertion	Innervation
Erector Spinae - Cervical Spinalis Column	Spinous processes	Spinous processes	Dorsal rami of spinal nerves
Obliquus Capitis Superior	Superior surface of transverse process of atlas	Occipital bone between inferior and superior nuchal line	Dorsal ramus of C1 - suboccipital nerve
Rectus Capitis Posterior Major	Spinous process of axis	Lateral portion of occipital bone below inferior nuchal line	Dorsal ramus of C1 - suboccipital nerve
Rectus Capitis Posterior Minor	Posterior tubercle of atlas	Medial portion of occipital bone below inferior nuchal line	Dorsal ramus of C1 - suboccipital nerve
Semispinalis Capitis	Transverse processes of C7-T6 and articular process of C4-C6	Between superior and inferior nuchal lines of occipital bone	Dorsal rami of middle and lower cervical spinal nerves
Semispinalis Cervicis	Transverse processes of T1-T6	Spinous processes of C2-C5	Dorsal rami of cervical spinal nerves
Splenius Capitis	Lower half of ligamentum nuchae and spinous processes of C7-T4	Below lateral 1/3 of superior nuchal line and mastoid process of temporal bone	Dorsal rami of middle cervical nerves
Splenius Cervicis	Spinous processes of T3-T6	Posterior tubercles of transverse processes C1-C3	Dorsal rami of lower cervical nerves
Upper Trapezius	Medial 1/3 superior nuchal line of occipital bone, external occipital protuberance, ligamentum nuchae, spinous processes C7-T12 and supraspinous ligament	Lateral 1/3 posterior border of clavicle, medial margin acromion process, spine of scapula to the smooth triangular space	Spinal accessory nerve CN XI and C3, C4 spinal nerves



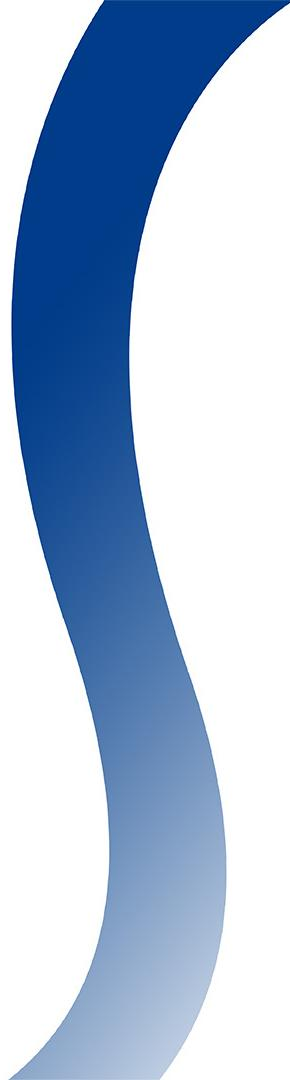
# Cervical Extension



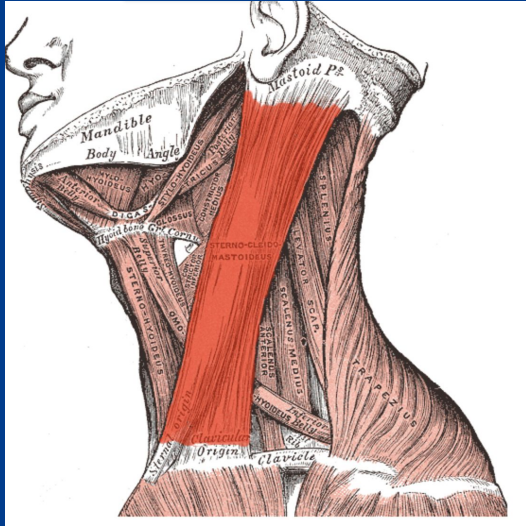
## Prone

- Can test in Standing, Sitting, Sidelying, and Prone
- Testing at different angles: **Neutral, Mid range, End Range**, etc
- **Usually without a strap**

## Cervical Side bend



## Cervical Left and Right Side bend



Muscle	Origin	Insertion	Innervation
Sternocleidomastoid	Sternal head - Manubrium of sternum, Clavicular head - Superior border of medial ½ of clavicle bone	Mastoid process of temporal bone and lateral half of superior nuchal line	Spinal accessory nerve CN XI and spinal nerve C2, C3, C4

## Cervical Side bend

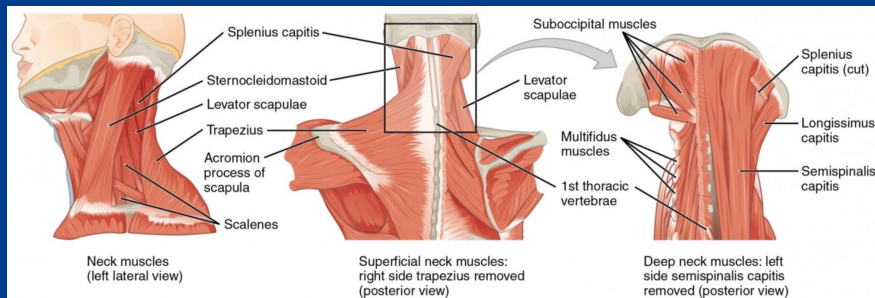


### Sidelying

- Can test in Standing, Sitting, Sidelying, and Supine
- Testing at different angles: **Neutral, Mid range, End Range**, etc
- **Usually without a strap**

## Cervical Rotation

# Cervical Rotation



## Rotation

### Semispinalis cervicis

Multifidus

Scalene anterior

Splenius cervicis and capitis

Sternocleidomastoid

Inferior oblique (head only)

Rectus capitis posterior major (head only)

## Cervical Rotation



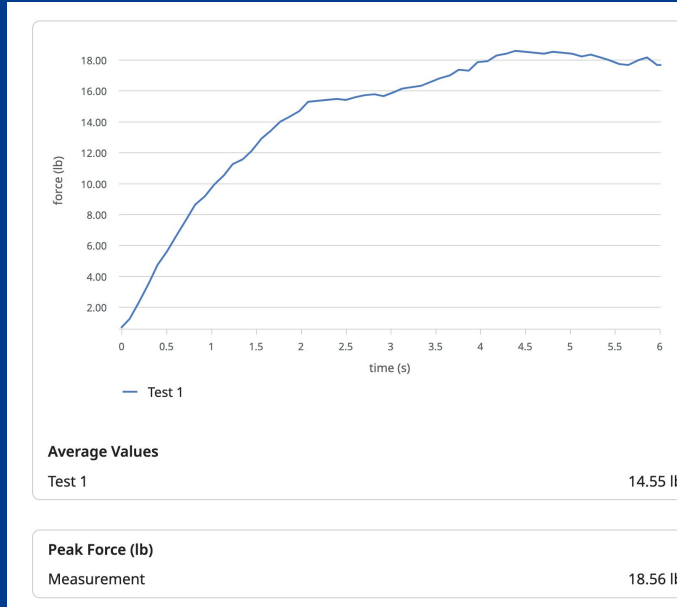
### Sidelying

- Can test in Standing, Sitting, Sidelying and Supine.
- Testing at different angles: **Neutral, Mid range, End Range**, etc
- Usually **without a strap**

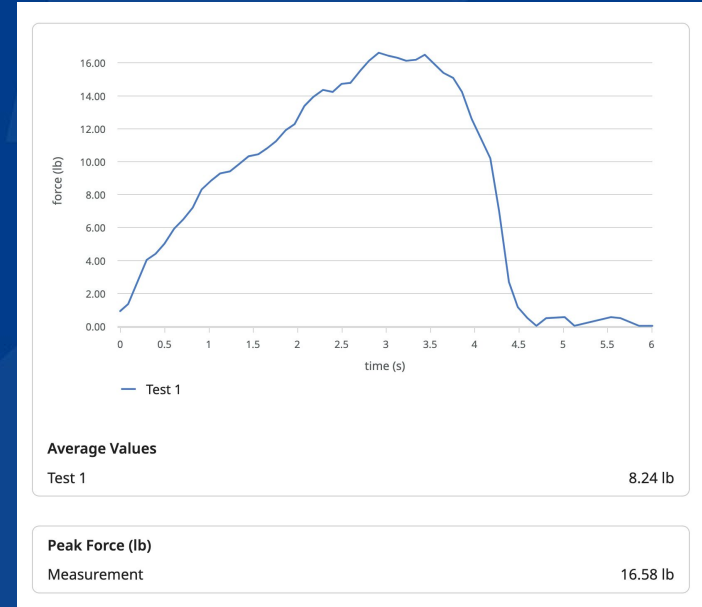
# Case Study: Neck Pain

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Flexion



Extension



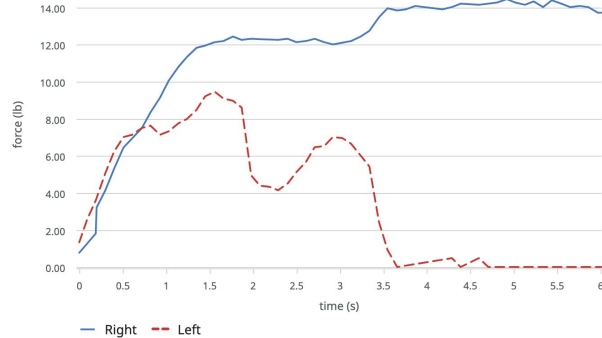
While only a 10% difference, according to research optimal Flexion/Extension ratio is .40 to .60 or extension should be between 30.9 lbs and 46.4 lbs.



# Case Study: Neck Pain

## Cervical Side Bend

- Pain with left Side bend
- Normal right side bend
- Higher than 10% difference between sides.



### Average Values

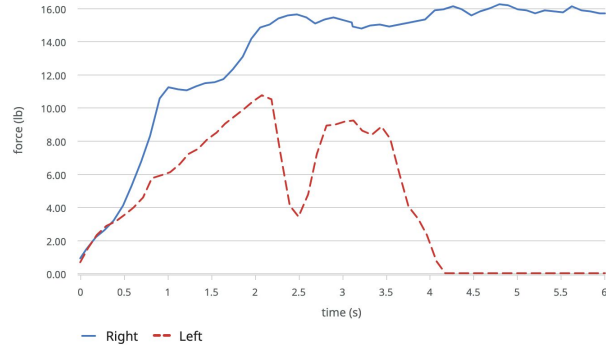
Right	11.97 lb
Left	3.75 lb

### Peak Force (lb)

Right	14.44 lb
Left	9.45 lb
Strength Difference	4.99 lb
Percentage Difference	41.79%

# Case Study: Neck Pain

## Cervical Rotation



### Average Values

Right	13.32 lb
Left	4.38 lb

### Peak Force (lb)

Right	16.22 lb
Left	10.74 lb
Strength Difference	5.49 lb
Percentage Difference	40.71%

- Pain with left rotation
- Normal right rotation
- Higher than 10% difference between sides.
- Poor NM control with left rotation

# Case Study: Neck Pain

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## Cervical Interventions

- Chin tucks
- Cervical rotation with beach ball.
- Cervical Isometrics with hand resistance
- Cervical Isometric walk outs with resistance bands
- Cervical motions with resistance

