Throwing can Increase the Stiffness of the Scalene Muscle

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I have no financial conflict of interest
Thoracic outlet syndrome (TOS)

- Thoracic outlet syndrome (TOS)
  A set of symptoms due to the compression of the brachial plexus and subclavian vessels in the region of the thoracic outlet.

- Location of neurovascular compression in TOS
  - Costoclavicular space
  - Pectoralis minor space
  - Scalene triangle (Scalenus anticus syndrome)
Scalenus anticus syndrome

Interval surrounded by the anterior and middle scalene muscles, and the first rib bone or cervical rib

Recently, exercise-induced TOS is becoming more common in baseball players.

However, the effect of throwing on the stiffness of the scalene muscles is unknown.

Specific Aims

- To quantitatively **measure the stiffness of the scalene muscles** using real-time shear wave elastography (SWE)

- Evaluate **effect of throwing** on the stiffness of the scalene muscles
Methods

- **Participants**
  - Thirty college baseball players for medical check-up
  - Mean age: 20.4 years (range, 19-21 years)

- **Arm positions**
  - **Position 1**: Adducted and neutral rotation of the shoulder
  - **Position 2**: 90 degrees of abduction and external rotation of the shoulder
    (Simulation of clinical examination)
Sonographic visualization of scalene muscles

✓ Position of US transducer (Fig 1)
  - Superior to the clavicular bone and parallel to its axis

✓ Visualization of Scalene muscles (Fig 2)
  - Visualize the superior surfaces of the anterior and middle scalene muscles parallel to the surface of the fifth cervical nerve

AS, anterior scalene muscle; MS, middle scalene muscle; FCN, fifth cervical nerve
Assessment of SWE

- **Measurement of SWE in scalene muscles**
  - Divide into **superior and deep areas of each scalene muscle**.
  - Stiffness defined by taking the average of three mm-diameter circles.

- **Statistics**
  - A repeated-measures analysis of variance (ANOVA).
  - Compare the stiffness of the **superior and deep areas in each scalene muscle** for the throwing and non-throwing side.
  - Values of \( p < 0.05 \) considered statistically significant.
Stiffness of Scalene muscle (throwing side)

- Adducted and neutral rotation of the shoulder (Position 1)
  - Deep part of middle scalene muscle > superior and deep parts of anterior scalene muscle
Stiffness of Scalene muscle (throwing side)

- 90 degrees of abduction and external rotation of the shoulder (Position 2)

- Superior and middle parts of middle scalene muscle > superior part of anterior scalene muscle

Non-throwing side
No significant difference in both of scalene muscles in both arm positions.
Discussions

✓ Moderate to severe hypertrophy of the anterior scalenus muscles has been found in professional athletes with TOS who underwent surgical treatment.  


This study

✓ On the throwing side, the muscle stiffness significantly increased in the superior area of middle scalene muscle.

✓ No contribution was identified in the scalene muscles on the non-throwing side.

Repeated throwing motion can increase the stiffness of the middle scalene muscle.
Summary

 ✓ Repetitive throwing motion can affect the stiffness of the middle scalene muscle.

 ✓ Reduction of the middle scalene muscle should be considered to treat throwing athletes with TOS.