

Measurement of strain on the deep layer of the supraspinatus tendon: The influence of shoulder elevation

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Introduction

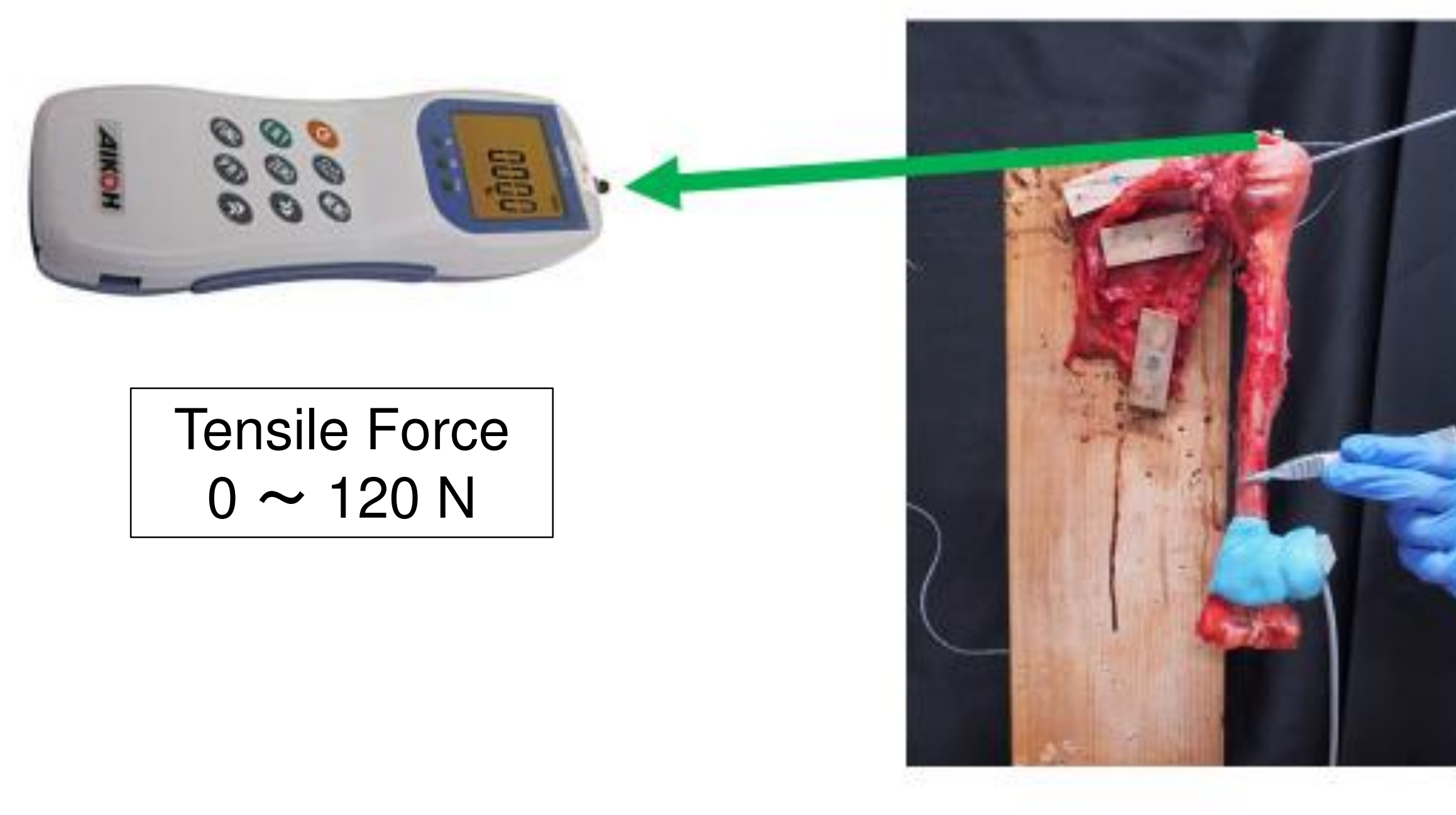
There are many approaches to physical therapy for shoulder joint dysfunction. The risk of dysfunction is increased by adding mechanical stress stimulation. However, there are no reports on the biomechanical characteristics of the deep layer of the supraspinatus tendon with changes in the elevation of the scapular plane.

Purposes

The purpose of this study was to reproduce to measure the strain on the deep layer of the supraspinatus tendon accompanying changes of the angle of elevation of the gleno-humeral joint in scapular plane.

Materials and Methods

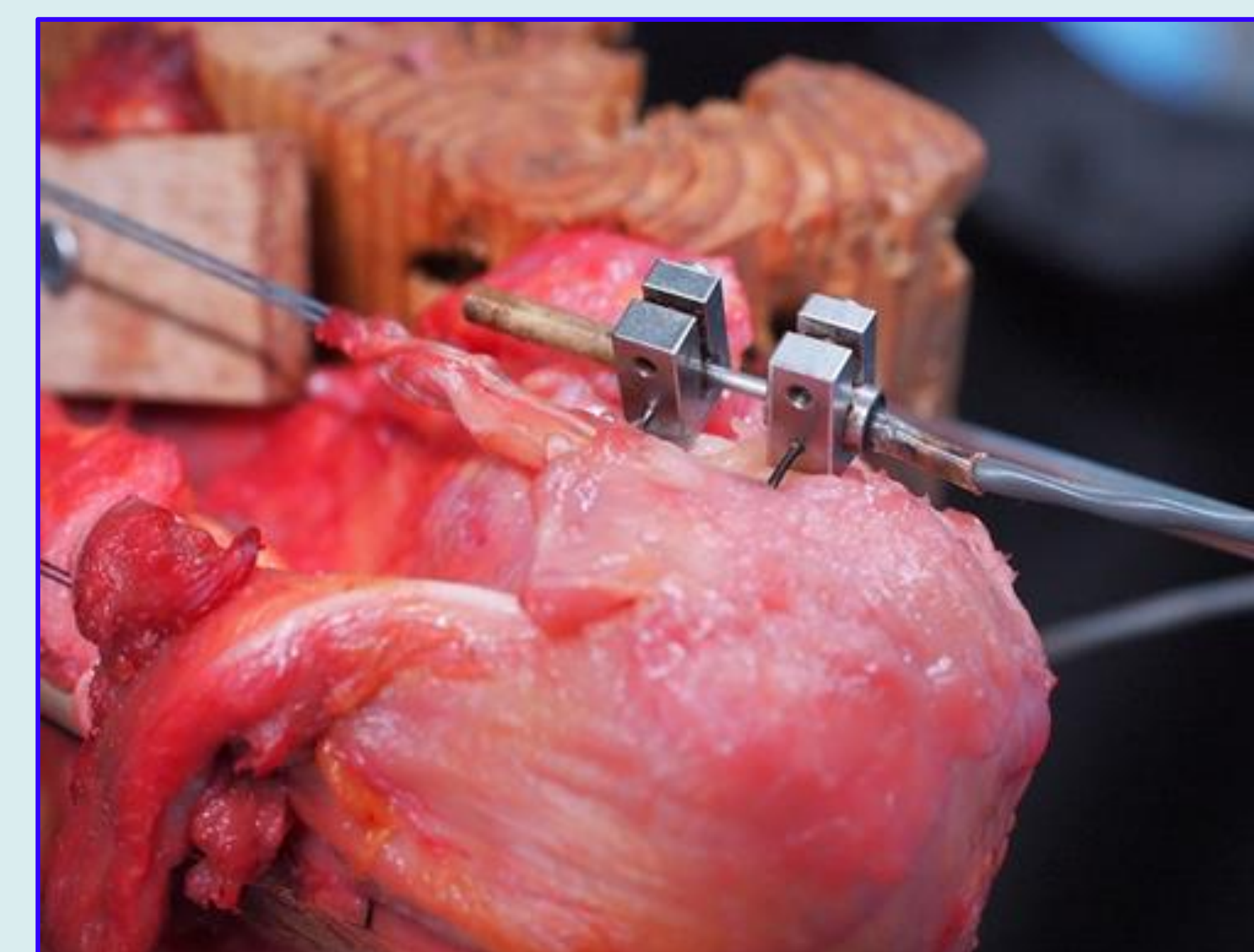
- Six fresh-frozen shoulder specimens (3 left, 3 right; average age 81.3 yrs)
- The tensile force on the supraspinatus tendon was loaded from 0 to 120 N.
- The strain on the deep layer of the supraspinatus tendon was measured using a strain gauge.
- The angle of the glenohumeral joint was changed from -10 to 30 degrees on the scapular plane, and the distal humerus was fixed to a jig at each angle.
- Physiological balanced traction to both subscapularis and infraspinatus tendons kept the humeral head in the glenoid fossa.



Tensile Force
0 ~ 120 N

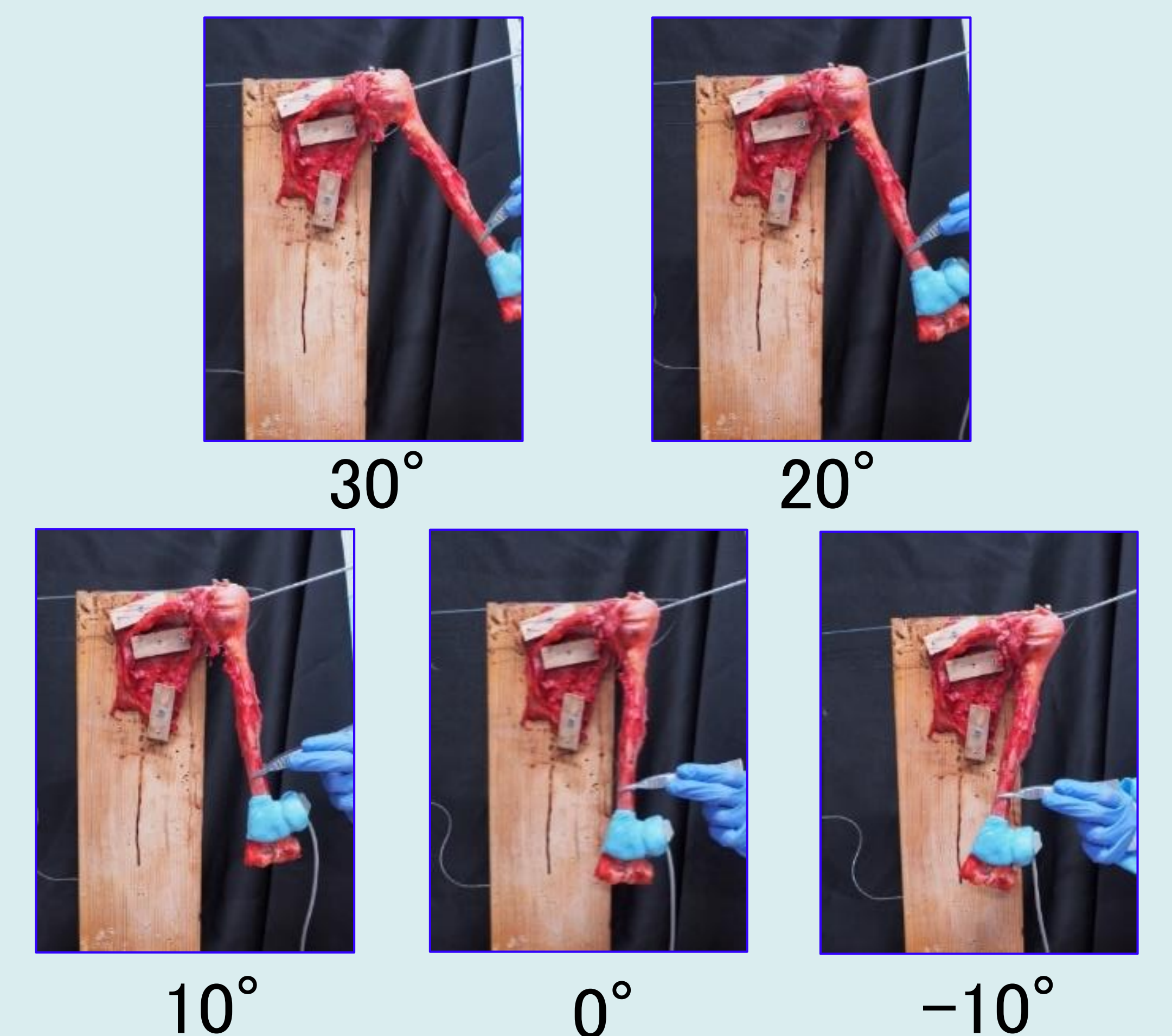
*Push-pull gage
(RZ-50, Aiko, Tokyo, Japan)*

Measurement of the tensile force
of the supraspinatus tendon



*Strain gage
(Pulse coder, LEVEX, Kyoto, Japan)*

Measurement of strain
on the deep layer
of the supraspinatus tendon



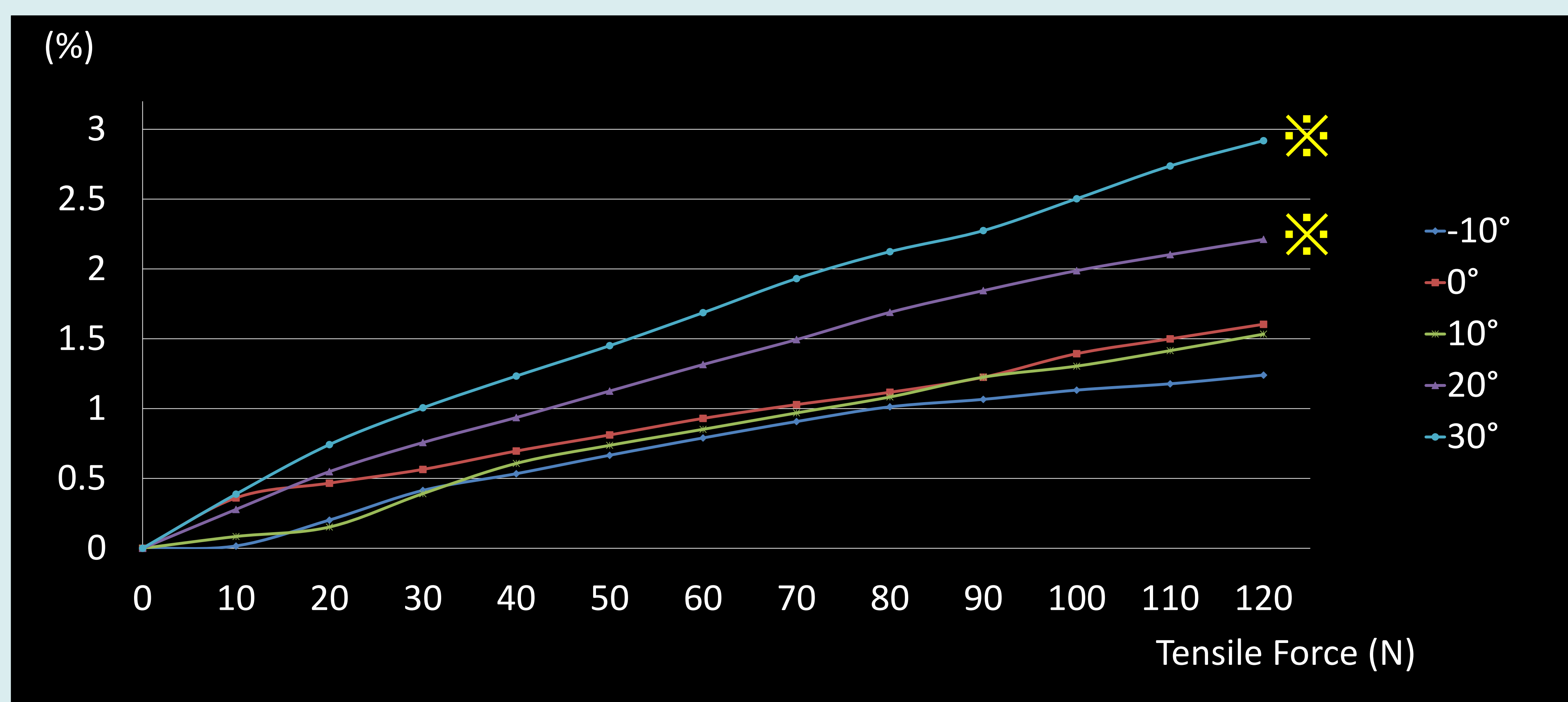
*A six-degree-of-freedom
electromagnetic tracking device
(3SPACE FASTRAK, Polhemus, Colchester, USA)*

Scapular plane elevation

Statistical analysis

Repeated 2-way ANOVA

Result



Strain on the deep layer of the supraspinatus tendon ✕ P < 0.05

Significant increases in the strain on the deep layer of the supraspinatus tendon were observed with increases in the tensile force on the supraspinatus tendon for isometric elevation of 30 and 20 degrees, but a little increase in the strain was observed at 10° or less of gleno-humeral elevation.

Significances

- The deep layer of the supraspinatus tendon is more elongated during elevation from 30 and 20 degrees.
- But at 10 or less degrees of scapular plane elevation there was slight elongation.
- During isometric elevation at 30 and 20 degrees, there is a risk of overstress in cases suffering degeneration.

Reference

Miyamoto H, et al:
Measurement of strain and tensile force of the supraspinatus tendon under conditions that simulates low angle isometric elevation of the gleno-humeral joint: Influence of adduction torque and joint positioning.
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