

Usability of the Dynamic Assessment of the Supraspinatus Using Ultrasonography

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COI Disclosure Information

Presenter : Junsuke Miyasaka

I have no financial relationships to disclose.

Background

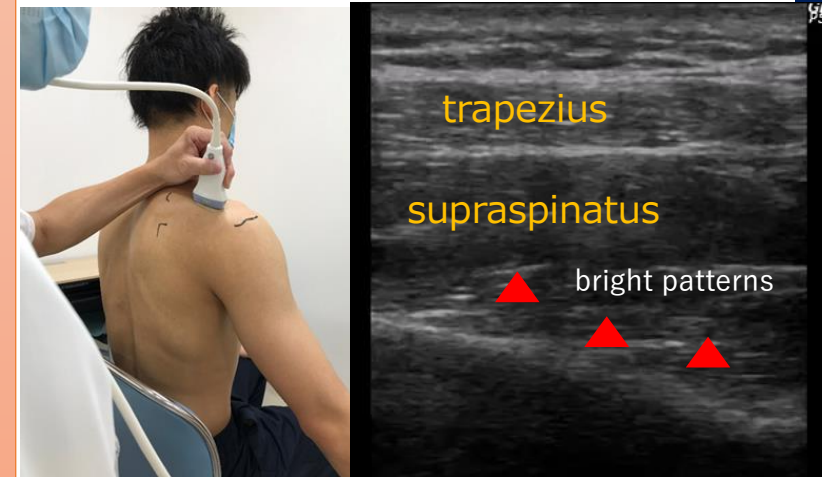
➤ Rotator cuff tear (RCT) is often assessed statically using Computed Tomography (CT) or Magnetic Resonance Imaging (MRI).

●Tear size	DeOrio and Cofield classification Patte classification Boileau classification	(DeOrio, Cofield 1984) (Patte 1990) (Boileau et al. 2005)
●fatty degeneration	Goutallier classification	(Goutallier et al. 1994)
●atrophy	Warner classification tangent sign	(Warner et al. 2001) (Zanetti et al. 1998)

Essentially, skeletal muscles are dynamic organs, and it is still left to be considered to evaluate how effectively the muscles are moving.

- ✓ We tried to devise a new method for dynamic assessment of the supraspinatus (SSP) using ultrasonography (US).
- ✓ SSP dynamic assessment focused on the following factors.
 1. Sufficient moving distance of the SSP during contraction
 2. Overall motion of the SSP during contraction (not partial motion)
 3. Good sliding below the trapezius muscle

However, it has not been confirmed what bright patterns in US represent and whether the moving distances of them reflect the movement of the muscle.



dynamic assessment of the SSP

Objectives

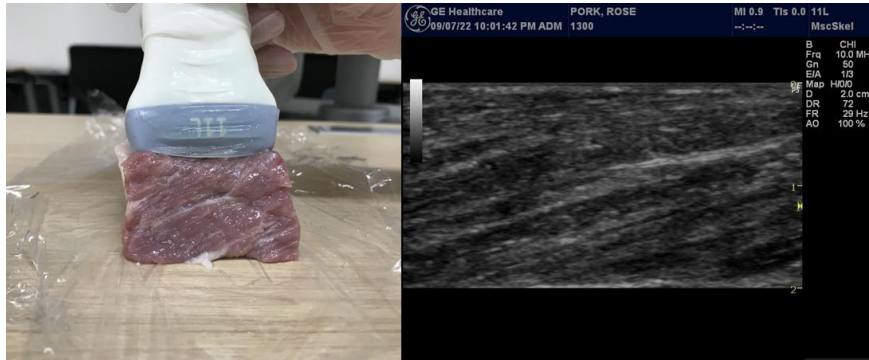
- 1) To clarify the anatomical structure shown in US as bright patterns in muscles.
; Study 1
- 2) To compare the moving distances of the speckle with marker placed on the SSP during passive SSP movement in cadaveric shoulders.
; Study 2

Study 1

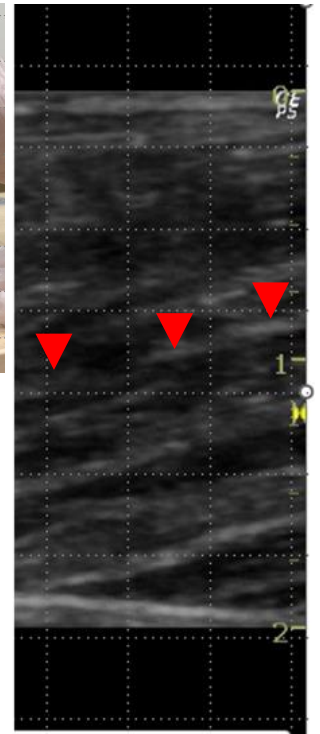
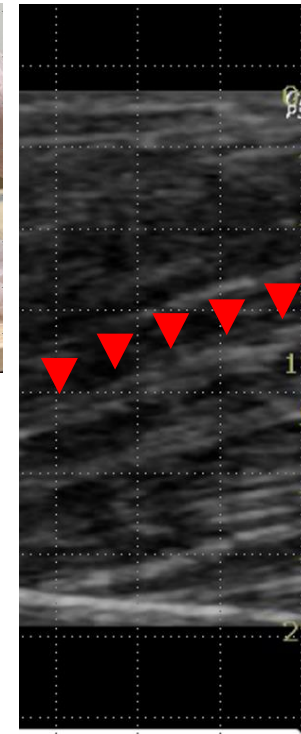
Methods

- Edible pork (belly) with fat on the surface was observed by US (LOGIQ P5, GE Healthcare, Chicago, IL, US)
- The gross findings were contrasted with the US images

Results



- Bright stripes were depicted on US.
- The fat layer was hypoechoic.

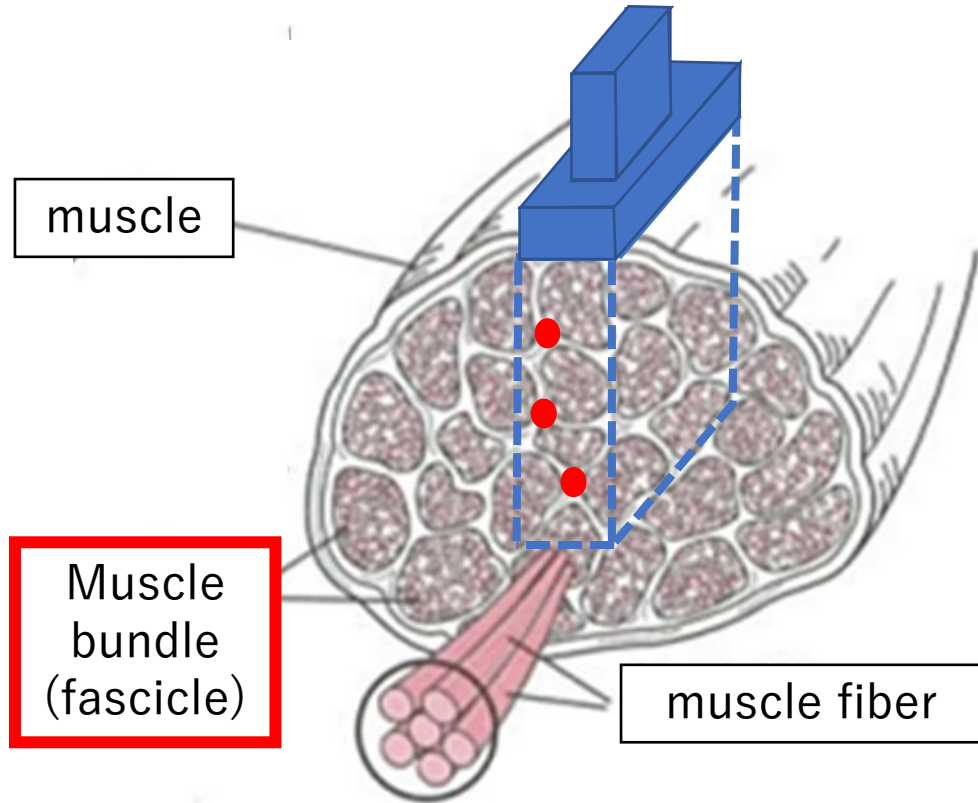


- When the probe was slightly rotated, the stripe pattern easily varied into dotted speckles.

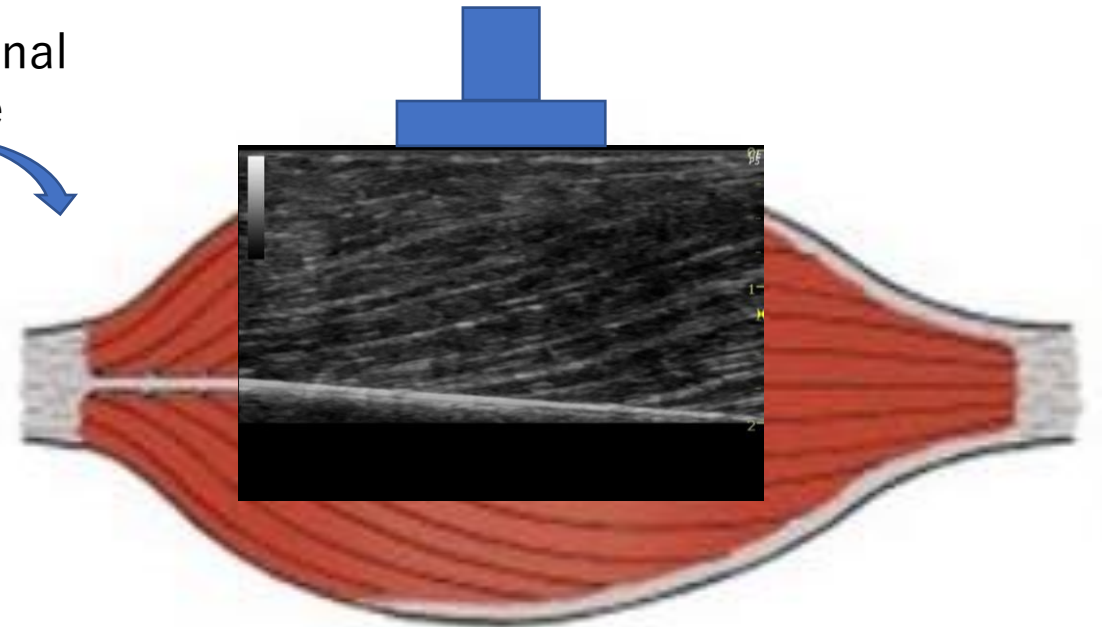
Discussion

➤ What is the bright stripes in the US image?

In this study the perimysium surrounding the muscle bundle was considered to be depicted as a high-intensity stripe pattern, which was supported by the previous studies. (Kawakami et al.1998, Fukunaga et al.2001)



Longitudinal image



- When the muscle bundle and the US probe are not perfectly parallel, the perimysium is depicted in fragments, forming speckles instead of stripes.

Discussion

➤ Dynamic assessment of the muscle movement

- ✓ It is difficult to keep capturing the movement of muscle bundles, which are three-dimensional structures, as lines with stripes on a two-dimensional US image.
- ✓ In the US image, a moving muscle bundle is basically taken as a speckle.
- ✓ Therefore, it is reasonable to assume that the speckle showing the greatest moving distance should mean that its muscle bundle is located **most parallel** to the probe and that the distance should be **close to the actual muscle movement**.

⇒ Study2; To compare the moving distances of the speckle and marker placed directly on the SSP.

Study 2

Methods

- Both shoulders of a cadaveric specimen without RCT

(male, 94 years old, cause of death; senility)

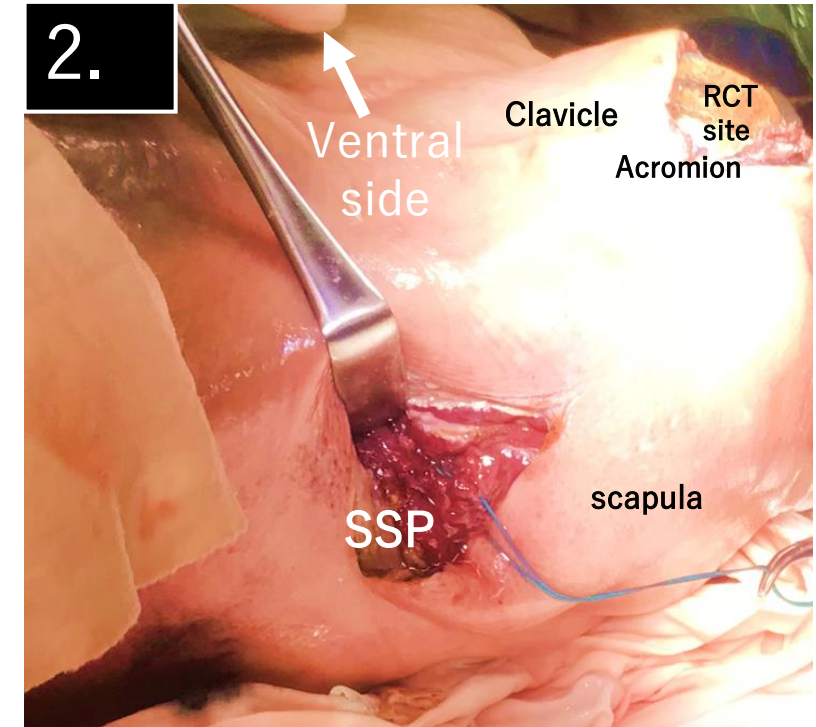
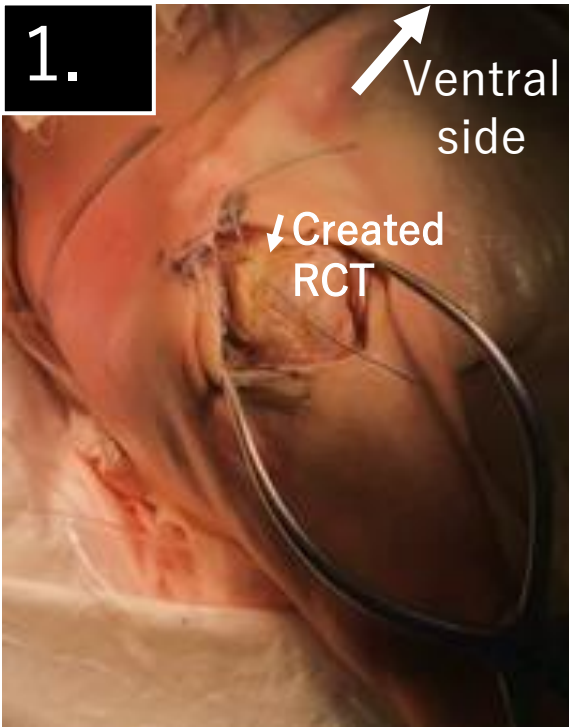
1. Small rotator cuff tears were created.
2. 5cm skin incision was made at the midpoint between the acromion and the medial edge of the supraspinous fossa.

The trapezius muscle was detached from the scapular spine and the muscle belly of the SSP was exposed.

A suture was looped around the muscular tissue of the **SSP as a marker** of the actual muscle movement.

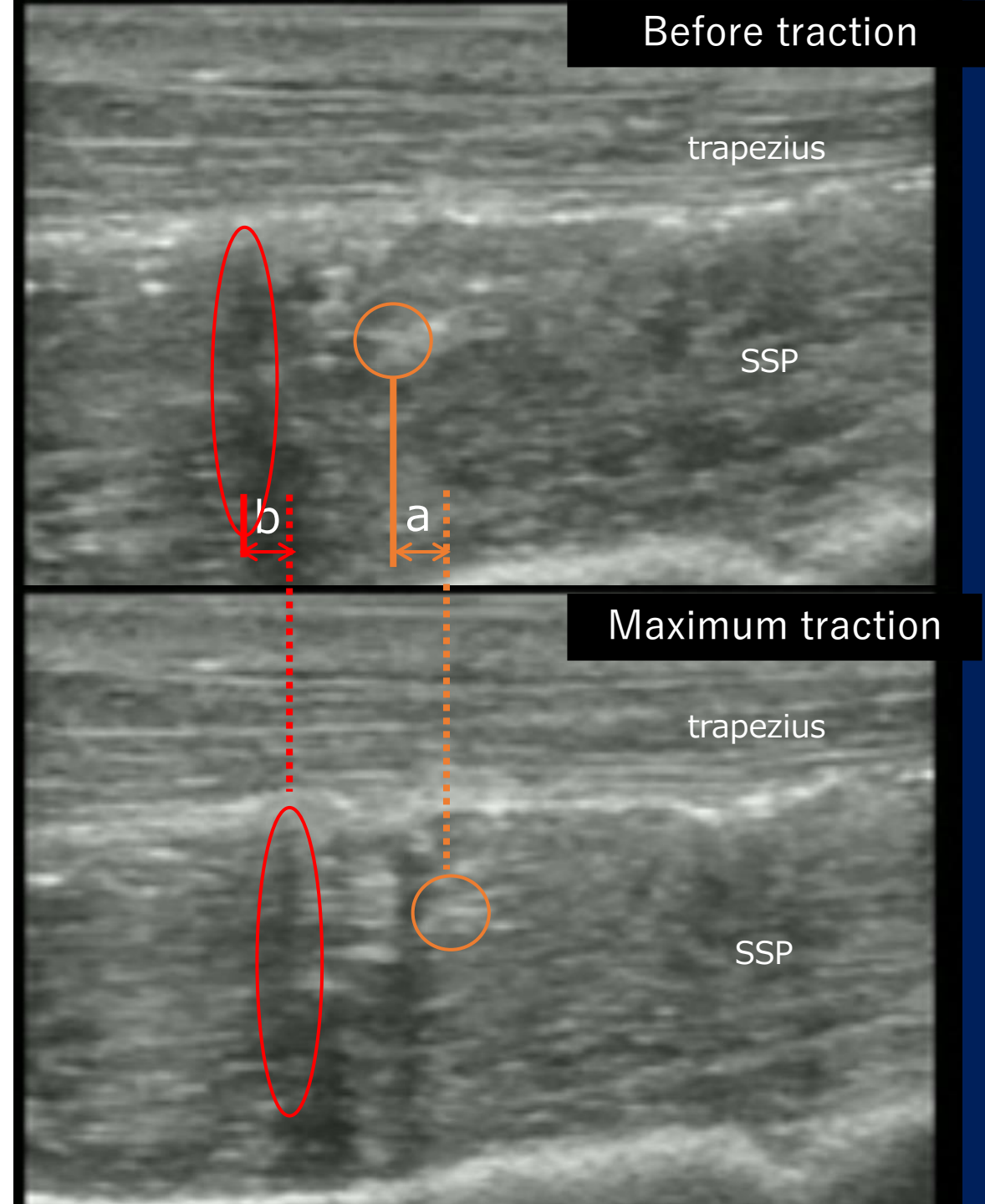
3. The US probe was applied in the longitudinal direction of the SSP. The edge of the rotator cuff tear was manually pulled by 0.5 cm and 1.0 cm two times, respectively. Movements of the SSP during traction were captured by US.

Right shoulder



Methods

- Measurement of the moving distance
 - ✓ The speckle showing the greatest moving distance on the US image was identified.
 - ✓ The part below the marker was hypoechoic.
 - ✓ Distances of the **speckle (a)** and **marker (b)** movement were measured by using 'Image J' software.
 - ✓ Their distances were compared.



Results

side	trial	traction distance	speckle	SSP marker
Right	trial 1	0.5	0.160	0.107
	trial 2		0.258	0.179
	trial 3	1.0	0.359	0.395
	trial 4		0.475	0.454
Left	trial 1	0.5	0.222	0.248
	trial 2		0.267	0.268
	trial 3	1.0	0.467	0.513
	trial 4		0.560	0.535

Discussion

- The moving distance of a representative speckle was almost the same as the SSP marker.

Muscle moving distance could be estimated by following the speckle showing greatest moving distance.

Conclusion

- **Study1 Edible pork study**

- High-intensity stripes in US images were muscle bundles.
- When the probe was not parallel to the muscle bundle, the perimysium surrounding the muscle bundle is depicted in fragments, forming speckles instead of stripes.

- **Study2 Cadaveric study**

- The moving distances of the speckle were almost same as those of the SSP marker during traction of the rotator cuff-edge.
- Actual muscle moving distance could be estimated by following the speckle showing the greatest moving distance.

References

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