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Title: Ultrasound-Guided Acupotomy Release with Biomechanical Assessment for Trapezius Myofascial Pain Syndrome

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Author Questionnaire

- 1. Microscopy:** Does your protocol require the use of a dissecting or stereomicroscope for performing a complex dissection, microinjection technique, or something similar? **No**

- 2. Software:** Does the part of your protocol being filmed include step-by-step descriptions of software usage? **No**

- 3. Filming location:** Will the filming need to take place in multiple locations? **No**

- 4. Testimonials (optional):** Would you be open to filming two short testimonial statements **live during your JoVE shoot**? These will **not appear in your JoVE video** but may be used in JoVE's promotional materials. **Yes**

Yi Rao, Associate Chief PHsician

Current Protocol Length

Number of Steps: 17

Number of Shots: 38

Interviews

Videographer: Obtain headshots for all authors available at the filming location.

INTRODUCTION:

~~REQUIRED: Summarize your research focus and the main questions it aims to answer.~~

- 1.1. **Zhuying Lin:** Our research focuses on Ultrasound-guided acupotomy release with biomechanical assessment for trapezius myofascial pain.
 - 1.1.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

~~Describe the research gap or limitation in existing methods and how this protocol addresses them.~~

- 1.2. **Zhuying Lin:** Existing blind acupotomy lacks objective guidance and precision; this protocol introduces visualized, accurate tissue release to improve safety and reproducibility.
 - 1.2.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

CONCLUSION:

~~What does this protocol allow researchers to study or measure?~~

- 1.3. **Zhangjing Shen:** This protocol allows researchers to measures soft-tension, stiffness, elasticity, and shear wave elastic modulus.
 - 1.3.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

~~Are there any additional methods or analyses that can be performed following this procedure?~~

- 1.4. **Zhangjing Shen:** This method can be applied to other myofascial pain sites, such as infraspinatus and quadratus lumborum.

- 1.4.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

~~How can future studies build on this work? Describe the questions or research directions that can be investigated next.~~

- 1.5. **Zhangjing Shen:** Future studies can improve baseline matching, extend follow-up duration, and evaluate the protocol's applicability across additional muscle groups and conditions.
 - 1.5.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

Videographer: Obtain headshots for all authors available at the filming location.

Testimonial Questions (OPTIONAL):

Videographer: Please capture all testimonial shots in a wide-angle format with sufficient headspace, as the final videos will be rendered in a 1:1 aspect ratio. Testimonial statements will be presented live by the authors, sharing their spontaneous perspectives.

What problem in your field of research does your JoVE article address?

- 1.6. **Yi Rao, Associate Chief Physician:** (authors will present their testimonial statements live)
 - 1.6.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

What is the key takeaway you hope viewers remember after watching your video article?

- 1.7. **Yi Rao, Associate Chief Physician:** (authors will present their testimonial statements live)
 - 1.7.1. INTERVIEW: Named talent says the statement above in an interview-style shot, looking slightly off-camera

Ethics Title Card

This research has been approved by the Medical Ethics Committee of Xiyuan Hospital. All participants provided written informed consent

Protocol

***Videographer:** Please always record an audio slate while filming each shot mentioned in the shotlist.*

2. Pretreatment Procedure for Trapezius Myofascial Pain Syndrome Acupotomy

Demonstrators: Yi Rao, Zhuying Lin

- 2.1. To begin, position the patient in a relaxed sitting posture with the back upright and the gaze directed forward [1]. Rest both arms naturally on the anterior thighs [2] and place the feet flat on the floor [3]. Ensure the affected trapezius region is fully exposed [4].
 - 2.1.1. WIDE: Talent adjusting the patient's posture and gaze. ***Videographer:** Please obtain CU shot as well for this shot*
 - 2.1.2. Talent positioning both arms naturally on the anterior thighs.
 - 2.1.3. Talent confirming the feet are flat on the floor.
 - 2.1.4. Talent exposing the affected trapezius region.
- 2.2. Ask the patient to identify the most painful area [1]. Then, apply a gradual vertical pressure of 2 to 3 kilograms within the taut band of the trapezius to locate the maximal tender point [2].
 - 2.2.1. The patient shows the most painful area.
 - 2.2.2. Talent applying gradual vertical pressure within the trapezius taut band.
- 2.3. Using a sterile gentian violet skin marker, draw a 0.5-centimeter diameter circle at the target point [1].
 - 2.3.1. Talent drawing a 0.5-centimeter diameter circle at the target point with a sterile gentian violet skin marker.
- 2.4. Disinfect the skin with povidone iodine using a circular motion from the center outward. Repeat 3 times, allowing 30 seconds of drying between applications [1]. Finally, cover the area with a sterile fenestrated drape centered on the marked point [2].
 - 2.4.1. Talent disinfecting the skin in a circular motion from the center outward with povidone iodine.
 - 2.4.2. Talent covering the area with a sterile fenestrated drape centered on the marked point.
- 2.5. Next, power on the color Doppler ultrasound system [1]. Connect the high-frequency linear-array probe of 4 to 18 megahertz [2] and set it to 17 megahertz [3]. Select the **MSK extremity preset** [4] and enable **tissue harmonic imaging** [5].

- 2.5.1. Talent powering on the color Doppler ultrasound system.
- 2.5.2. Talent connecting the high-frequency linear-array probe.
- 2.5.3. Show the probe frequency set to 17 megahertz.
- 2.5.4. Show selection of the musculoskeletal extremity preset.
- 2.5.5. Show tissue harmonic imaging enabled.
- 2.6. Set the depth to 3 to 4 centimeters, the power to 95 percent, the frame rate to 35 hertz, and the gain to 60 to 70 decibels [1]. Adjust time gain compensation for uniform brightness [2]. Then, position the focus at the deep fascia [3].
 - 2.6.1. Show the depth set to 3 to 4 centimeters, power set to 95 percent, frame rate set to 35 hertz, gain set to 60 to 70 decibels.
 - 2.6.2. Show adjustment of time gain compensation for uniform brightness.
 - 2.6.3. Show the focus positioned at the deep fascia.
- 2.7. Apply 2 to 3 milliliters of medical ultrasound coupling gel to the probe surface [1].
 - 2.7.1. Talent applying medical ultrasound coupling gel to the probe surface.
- 2.8. Cover the probe with a disposable sterile medical glove [1]. Expel air to create a smooth surface [2] and secure the distal end with 2 finger stalls [3]. Disinfect the glove's outer surface with sterile povidone-iodine [4].
 - 2.8.1. Talent covering the probe with a disposable sterile medical glove.
 - 2.8.2. Talent expelling air from the glove to create a smooth surface.
 - 2.8.3. Talent securing the distal end with 2 finger stalls.
 - 2.8.4. Talent disinfecting the glove outer surface with sterile povidone iodine.
- 2.9. Instruct the patient to inform the physician immediately of any discomfort during the procedure [1].
 - 2.9.1. Talent instructs the patient to report any discomfort during the procedure.

3. Ultrasound-Guided Acupotomy for Trapezius Myofascial Pain

- 3.1. Place the ultrasound probe along the direction of the trapezius muscle fibers with the long axis of the probe parallel to the fiber orientation [1]. Position the probe perpendicularly on the skin over the marked point while maintaining stable probe-to-skin contact with skin indentation less than 0.5 centimeters [2].
 - 3.1.1. Talent placing the ultrasound probe along the direction of the trapezius muscle fibers.
 - 3.1.2. Talent positioning the probe perpendicularly on the skin over the marked point while maintaining stable contact.

- 3.2. Slowly move the probe along the fiber direction to scan and identify areas of locally thickened fascia [1]. Center the thickest part of the thickened fascia under the probe [2].
 - 3.2.1. Talent slowly moves the probe along the fiber direction and scans the trapezius region.
 - 3.2.2. Show the thickened fascia centered under the probe.
- 3.3. Insert the acupotomy needle percutaneously at a point 0.5 centimeters lateral to the probe long-axis marker [1].
 - 3.3.1. Talent inserting the acupotomy needle percutaneously lateral to the probe marker.
- 3.4. Under real-time ultrasound guidance, advance the needle medially to laterally toward the shoulder joint at a 10 to 15-degree angle to the skin, parallel to the trapezius muscle long axis [1]. Guide the needle tip to the superficial fascial layer [2].
 - 3.4.1. Talent advancing the needle at an angle of 10 to 15 degrees relative to the skin.
 - 3.4.2. Show the needle tip positioned at the superficial fascial layer.
- 3.5. Perform 3 to 5 oblique release motions until a palpable loss of resistance is felt or ultrasound shows fascial separation and improved sliding [1].
 - 3.5.1. Show the acupotomy needle performing oblique release motions with fascial separation.
- 3.6. Withdraw the needle to the subcutaneous level [1], adjust the insertion angle to approximately 45 degrees, and advance the needle tip to the deep fascial layer under ultrasound guidance [2]. Perform 3 to 5 oblique release motions with a 5-millimeter longitudinal movement at a frequency of 1 hertz until loss of resistance is felt or ultrasound shows fascial separation and improved sliding [3].
 - 3.6.1. Talent withdrawing the needle to the subcutaneous level.
 - 3.6.2. Show the needle tip advancing to the deep fascial layer at an approximately 45-degree angle under ultrasound guidance.
 - 3.6.3. Show the acupotomy needle performing oblique release motions with fascial separation and improved sliding visible under ultrasound guidance.
- 3.7. Then, withdraw the needle completely [1]. Apply firm pressure to the needle site with a sterile cotton ball for 30 seconds and cover the site with a sterile adhesive dressing [2]. Assist the patient in adjusting their clothing [3].
 - 3.7.1. Talent withdrawing the needle completely.
 - 3.7.2. Talent applying firm pressure to the needle site with a sterile cotton ball and covering the site with a sterile adhesive dressing.
 - 3.7.3. Talent assisting the patient in adjusting their clothing.

3.8. Finally, apply shear wave elastography and digital palpation to quantitatively assess soft tissue biomechanical properties under resting and passive stretching conditions [1].

3.8.1. Representative shot of the talent moving the probe over the target area with the ultrasound screen in the frame.

Results

4. Results

4.1. No significant differences were observed among the 3 groups in baseline characteristics, including sex, age, and body mass index, indicating comparability [1].

4.1.1. LAB MEDIA: Table 1.

4.2. In the acupotomy group, visual analog scale scores at both 1 and 2 weeks post-treatment were significantly lower than baseline and 0-week measurements [1].

4.2.1. LAB MEDIA: Figure 3A. *Video editor: Highlight the orange boxes at "Week 1, and "Week 2" which is visibly lower than the baseline and 0-wk boxes*

4.3. The resting-state shear wave elastography value decreased significantly immediately post-treatment at 0 week compared to baseline [1] and remained significantly lower at 1 week and 2 weeks [2].

4.3.1. LAB MEDIA: Figure 3B. *Video editor: Highlight the orange box at "0 week," and at "baseline"*

4.3.2. LAB MEDIA: Figure 3B. *Video editor: Highlight the orange box at "Week 1," and "Week 2," and "baseline"*

4.4. In the acupotomy group, muscle tone under both resting [1] and passive stretching states was significantly reduced at 1 and 2 weeks compared to 0 weeks [2].

4.4.1. LAB MEDIA: Figure 3D. *Video editor: Highlight the orange box at "Week 1" and "week 2" and compare it to "0 wk" box*

4.4.2. LAB MEDIA: Figure 3G. *Video editor: Highlight the acupotomy group box at "Week 1," and "Week 2" and compare it to "0 wk" box*

4.5. Stiffness was significantly reduced at 1 and 2 weeks compared to baseline in both resting and passive stretching states [1].

4.5.1. LAB MEDIA: Figure 3E and H. *Video editor: Highlight the orange box at "Week 1," and "Week 2" which is lower than the "0 wk" box*

4.6. In the acupotomy group, the resting-state elasticity at 1 week was significantly lower than at 0 week [1]. By 2 weeks, the elasticity in the acupotomy group at rest was

significantly lower than at 0 weeks [2] and baseline [3].

- 4.6.1. LAB MEDIA: Figure 3F. *Video editor: Highlight the orange box at “Week 1,” which and compare it to the “0 wk” box*
- 4.6.2. LAB MEDIA: Figure 3F. *Video editor: Highlight the orange group box at “Week 2” and compare it with the “0 wk” box*
- 4.6.3. LAB MEDIA: Figure 3F. *Video editor: Highlight the orange box at “Week 2” and compare it with the baseline box*
- 4.7. At the 2-week follow-up, elasticity in the acupotomy group under passive stretching was significantly lower than that in the blank control group [1].
 - 4.7.1. LAB MEDIA: Figure 3I. *Video editor: Highlight the orange box at “Week 2” and compare it with the blank control group box at the same time point*

1. Trapezius
Pronunciation link: <https://www.merriam-webster.com/dictionary/trapezius>
IPA: /trəˈpiːziəs/
Phonetic Spelling: truh·pee·zee·uhs
2. Anterior
Pronunciation link: <https://www.merriam-webster.com/dictionary/anterior>
IPA: /ænˈtɪriər/
Phonetic Spelling: an·teer·ee·ur
3. Vertical
Pronunciation link: <https://www.merriam-webster.com/dictionary/vertical>
IPA: /ˈvɜːtɪkəl/
Phonetic Spelling: vur·tuh·kuhl
4. Taut
Pronunciation link: <https://www.merriam-webster.com/dictionary/taut>
IPA: /ˈtɔːt/
Phonetic Spelling: tawt
5. Gentian
Pronunciation link: <https://www.merriam-webster.com/dictionary/gentian>
IPA: /ˈdʒenʃən/
Phonetic Spelling: jen·shuhn
6. Povidone
Pronunciation link: <https://www.howtopronounce.com/povidone>

- IPA: /'pɑ:və,doʊn/
Phonetic Spelling: pah·vuh·dohn
7. Iodine
Pronunciation link: <https://www.merriam-webster.com/dictionary/iodine>
IPA: /'aɪə,daɪn/
Phonetic Spelling: eye·uh·dyne
 8. Fenestrated
Pronunciation link: <https://www.howtopronounce.com/fenestrated>
IPA: /'fɛnə,streɪtɪd/
Phonetic Spelling: fen·uh·stray·tid
 9. Doppler
Pronunciation link: <https://www.merriam-webster.com/dictionary/Doppler>
IPA: /'dɑ:plər/
Phonetic Spelling: daap·lur
 10. Ultrasound
Pronunciation link: <https://www.merriam-webster.com/dictionary/ultrasound>
IPA: /'ʌltrə,saʊnd/
Phonetic Spelling: ul·truh·sound
 11. Megahertz
Pronunciation link: <https://www.merriam-webster.com/dictionary/megahertz>
IPA: /'megə,hɜ:ts/
Phonetic Spelling: meg·uh·hurts
 12. Musculoskeletal
Pronunciation link: <https://www.merriam-webster.com/dictionary/musculoskeletal>
IPA: /,mʌskjələ'skelətl/
Phonetic Spelling: mus·kyuh·luh·skel·uh·tl
 13. Harmonic
Pronunciation link: <https://www.merriam-webster.com/dictionary/harmonic>
IPA: /hɑ:r'mɑ:nɪk/
Phonetic Spelling: har·mon·ik
 14. Compensation
Pronunciation link: <https://www.merriam-webster.com/dictionary/compensation>
IPA: /,kɑ:mpən'seɪʃən/
Phonetic Spelling: kom·puhn·say·shuhn
 15. Fascia
Pronunciation link: <https://www.merriam-webster.com/dictionary/fascia>
IPA: /'fæʃ(i)ə/
Phonetic Spelling: fash·ee·uh
 16. Coupling
Pronunciation link: <https://www.merriam-webster.com/dictionary/coupling>
IPA: /'kʌplɪŋ/
Phonetic Spelling: kup·ling
 17. Disposable
Pronunciation link: <https://www.merriam-webster.com/dictionary/disposable>

- IPA: /dɪˈspʊzəbəl/
Phonetic Spelling: dih·spoh·zuh·buhl
18. Distal
Pronunciation link: <https://www.merriam-webster.com/dictionary/distal>
IPA: /ˈdɪstəl/
Phonetic Spelling: dis·tuhl
19. Acupotomy
Pronunciation link: <https://www.howtopronounce.com/acupotomy>
IPA: /ˌækjuːˈpɑːtəmi/
Phonetic Spelling: ak·yoo·pot·uh·mee
20. Percutaneously
Pronunciation link: <https://www.howtopronounce.com/percutaneously>
IPA: /pərˌkjuːˈtɛniəsli/
Phonetic Spelling: pur·kyoo·tay·nee·uhs·lee
21. Medially
Pronunciation link: <https://www.merriam-webster.com/dictionary/medial>
IPA: /ˈmiːdiəli/
Phonetic Spelling: mee·dee·uh·lee
22. Superficial
Pronunciation link: <https://www.merriam-webster.com/dictionary/superficial>
IPA: /ˌsuːpərˈfiʃəl/
Phonetic Spelling: soo·pur·fish·uhl
23. Subcutaneous
Pronunciation link: <https://www.merriam-webster.com/dictionary/subcutaneous>
IPA: /ˌsʌbkjuːˈtɛniəs/
Phonetic Spelling: sub·kyoo·tay·nee·uhs
24. Longitudinal
Pronunciation link: <https://www.merriam-webster.com/dictionary/longitudinal>
IPA: /ˌlɑːndʒəˈtuːdənəl/
Phonetic Spelling: lon·juh·too·duh·nuhl
25. Adhesive
Pronunciation link: <https://www.merriam-webster.com/dictionary/adhesive>
IPA: /ədˈhiːsɪv/
Phonetic Spelling: ad·hee·siv
26. Elastography
Pronunciation link: <https://www.howtopronounce.com/elastography>
IPA: /ɪˌlæˈstɑːgrəfi/
Phonetic Spelling: ih·las·tog·ruh·fee
27. Biomechanical
Pronunciation link: <https://www.merriam-webster.com/dictionary/biomechanical>
IPA: /ˌbaɪoʊməˈkænɪkəl/
Phonetic Spelling: by·oh·muh·kan·ih·kuhl
28. Visual Analog Scale
Pronunciation link: <https://www.howtopronounce.com/visual-analog-scale>

IPA: /'vɪʒuəl 'ænələʒiːski/

Phonetic Spelling: vizh·oo·uhl an·uh·log skayl

29. Stiffness

Pronunciation link: <https://www.merriam-webster.com/dictionary/stiffness>

IPA: /'stɪfnəs/

Phonetic Spelling: stif·nuhs

30. Elasticity

Pronunciation link: <https://www.merriam-webster.com/dictionary/elasticity>

IPA: /ɪˌlæ'stɪsəti/

Phonetic Spelling: ih·las·tiss·uh·tee