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The Effects of Dry Needling on Muscle Blood Flow of the Infraspinatus in Individuals with Shoulder Pain

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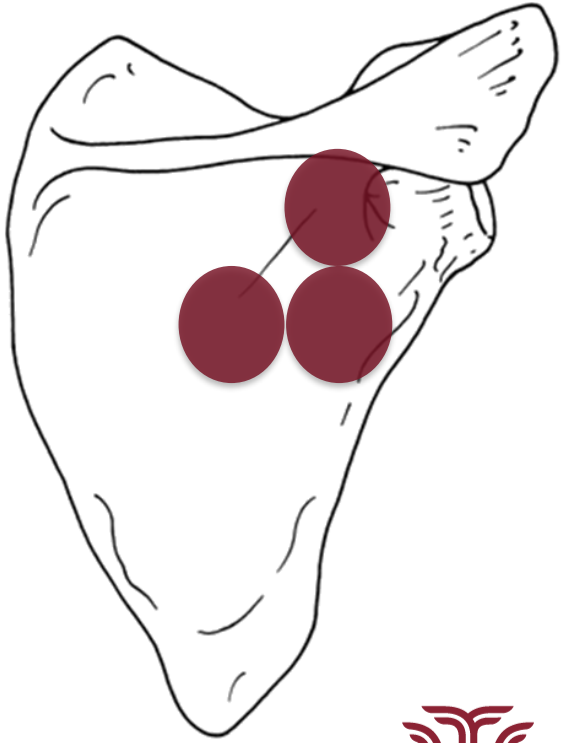
Background

Shoulder pain is one of the major reasons patients consult with primary healthcare providers.[1]

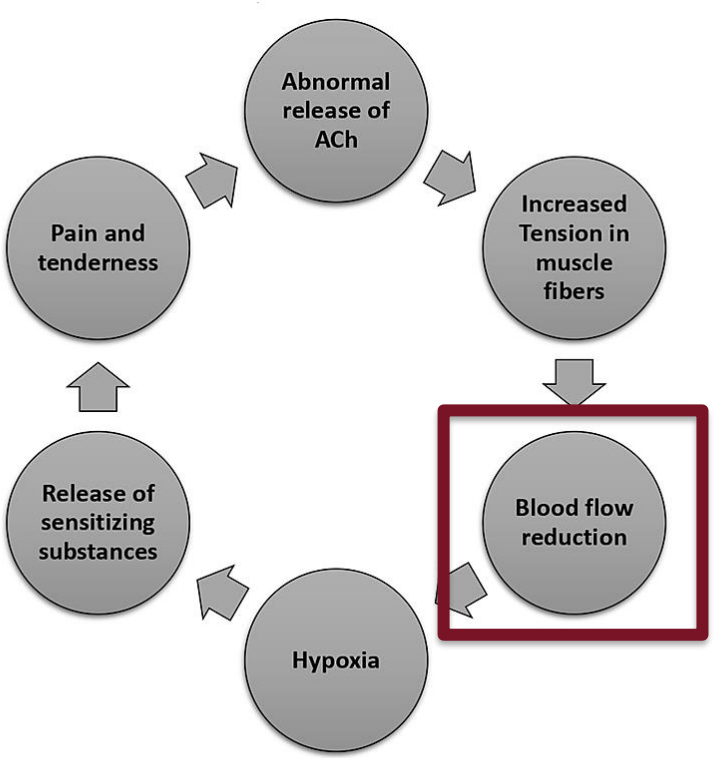
- More than 4.5 million patient visits annually[2]
- 7/10 people will experience shoulder pain in their life[3,4]
- Recovery from shoulder pain is slow with a recurrence rate of up to 25%[3]

Myofascial Trigger Points and Shoulder Pain

- A myofascial trigger point (MTrP) is a hyperirritable taut band of tissue that produces pain when palpated[5]
  - Higher occurrence of MTrPs in individuals with shoulder pain compared to healthy individuals[6]
  - Correlated with higher pain intensity, longer duration of symptoms, and higher disability[7]



Pathophysiology of MTrPs[5]



Dry Needling for MTrPs

- Dry Needling (DN) has been proposed as a treatment for MTrPs.
  - Little evidence on the effects of DN on muscle blood flow
    - Adigozali et al. (2019): Improvements in blood flow to the upper trapezius following DN to MTrPs in women with myofascial pain[9]

Purpose of the Study

Primary Purpose:

- Examine the effect of DN on the blood flow of the infraspinatus muscle using CDUS in individuals with shoulder pain

Secondary Purpose:

- Examine the effect of DN on:
  - Sensitivity to pressure
  - Shoulder range of motion

Comparing the differences between real DN and sham DN

Research Design

- Study Design:
  - Single-blinded randomized comparison trial
  - Prospective two-way (2 x 2) mixed design
- Two IVs: Group and Time
  - Group:
    (1) Experimental group received real dry needling (DN)
    (2) Placebo group received sham DN
  - Time: (1) Before DN, (2) After DN

Participants

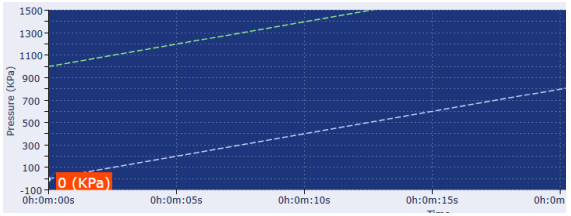
- Sample size estimations
  - Gpower: Used a medium effect size *f* = 0.25 and an alpha level of 0.05[9]
  - 40 participants required to reach 80% power
- Inclusion Criteria:
  - Ages 18-65
  - Non-traumatic origin of pain
  - Pain level ≥ 2/10 on the NPRS in the last 24 hours
  - Presence of at least one MTrP defined as a taut band of tissue, hypersensitive spot, or reproduction of pain to palpation in the infraspinatus muscle belly[11]

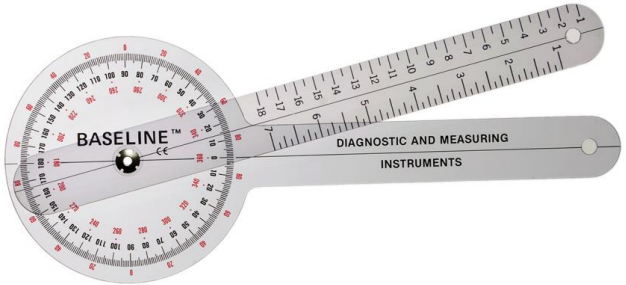
Exclusion Criteria:

- Bleeding disorders, use of anti-coagulants, systemic joint disease, cancer of the upper quadrant, cervical radiculopathy, neurological disorders, diabetes mellitus, fibromyalgia, and inability to obtain the testing position (prone)

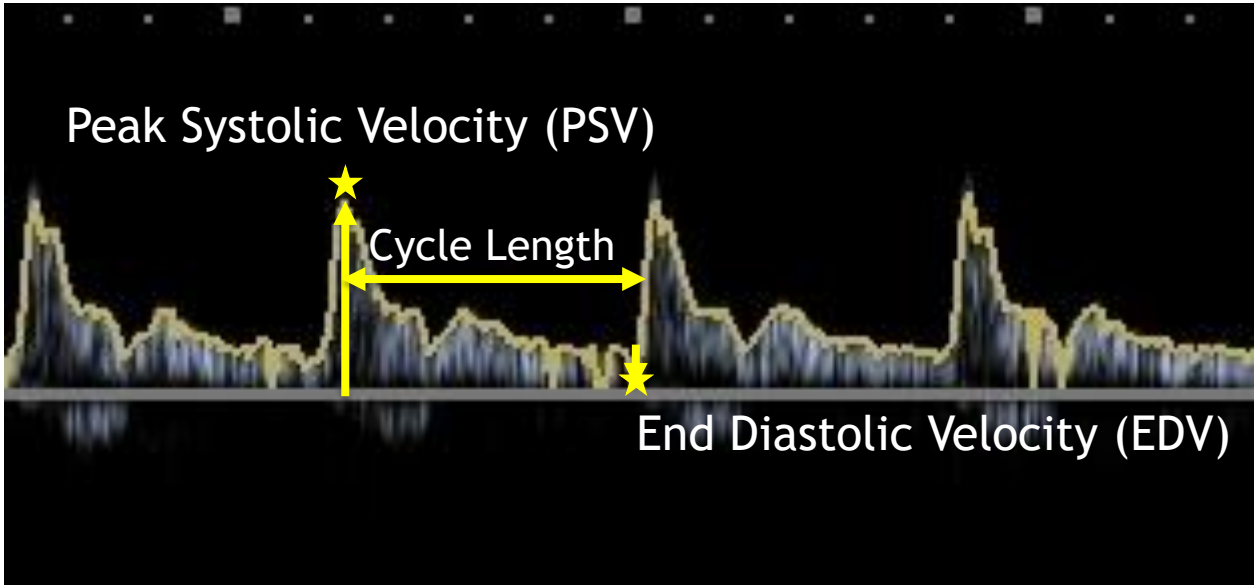
Instrumentation

- Color Doppler Ultrasound
- Computerized Pressure Pain Algometer
- Goniometry for Shoulder Internal and External Rotation Range of Motion





Color Doppler Ultrasound



Resistive Index (RI) = (PSV-EDV)/PSV
Pulsatile Index (PI) = PSV-EDV/Mean Flow Velocity

Outcome Measurement Administration

Before the DN intervention:

1. Shoulder ROM of Internal Rotation (IR) and External Rotation (ER)
2. Pain Pressure Threshold (PPT)
3. Blood flow parameters

Randomized to receive Real DN or Sham DN

Immediately following the DN intervention:

1. Blood flow parameters
2. PPT
3. Shoulder ROM of IR and ER

Intervention:

Real DN

- A monofilament needle was inserted into the infraspinatus muscle and pistoned in an up-and-down motion and redirected at small angles at approximately 1Hz for 10 seconds.
  - 2-4 MTrPs

Sham DN

- To mimic a real DN intervention, the participant's skin was cleaned with an alcohol pad and the placebo needle was placed in a plastic tube.
- The participant's skin was pricked using the placebo needle at 1 Hz for 10 seconds, and the placebo needle was discarded into the sharp container.
  - 2-4 MTrPs

Participants' Baseline Characteristics (Count or Mean ± SD)

	Sham DN	Real DN	p-value
Age (years)	35.9 ± 13.9	33.8 ± 12.9	0.624
BMI (kg/m^2)	27.2 ± 6.4	24.3 ± 3.3	0.079
NPRS - Current (0-10)	3.0 ± 1.5	3.1 ± 1.5	0.753
NPRS – Best (0-10)	1.45 ± 2.04	1.15 ± 1.69	0.616
NPRS – Worst (0-10)	4.70 ± 2.15	4.00 ± 1.86	0.279
QuickDASH	22.3 ± 17.3	24.0 ± 12.4	0.722
Number of MTrP	2.7 ± 0.6	2.9 ± 0.6	0.304
Duration of shoulder pain (months)	63.3 ± 48.6	62.2 ± 72.5	0.955

Participants' Baseline Primary Outcome Measures (Mean ± SD, counts)

	Sham DN	Real DN	p-value*
PSV (cm/s)	25.94 ± 6.51	29.53 ± 7.00	0.102
RI	1.02 ± 0.04	1.00 ± .072	0.186
PI	4.90 ± 1.50	4.16 ± 1.16	0.089
*Independent t-test			

	Sham DN	Real DN
EDV (cm/s)		
Positive (>0)	1	5
Negative (<0)	19	15
χ^2 (1, N = 40) = 3.14, p = 0.077		

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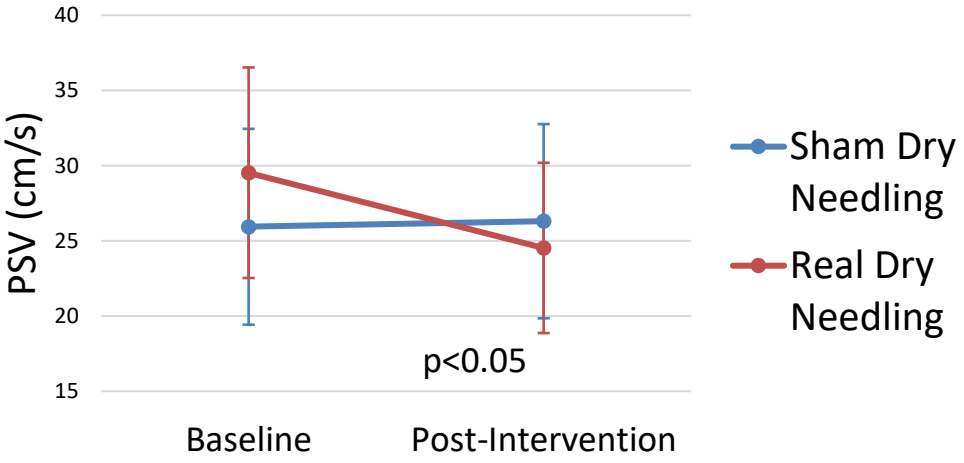
Participants' Baseline Secondary Outcome Measures (Mean ± SD)

	Sham DN	Real DN	p-value
PPT (KPa)	292.6 ± 207.9	280.3 ± 154.7	0.834
Shoulder IR (°)	55.3 ± 8.7	58.6 ± 10.3	0.284
Shoulder ER (°)	83.6 ± 15.01	83.4 ± 15.8	0.959

Blood Flow Parameters

- The RM ANOVA result showed a significant interaction between groups following DN for PSV, $F(1,38) = 59.636$, $p < 0.001$ with the *real DN group* having **significantly lower PSV** than the sham DN group immediately after the DN intervention.
- No significant differences in **EDV**. No significant differences in the interaction of time and group or the main effect of time for **RI** and **PI**.

	Sham DN (n = 20)	Real DN (n = 20)
PSV		
Pre	25.94 ± 6.51	29.53 ± 7.00
Post	26.31 ± 6.46	24.53 ± 5.66



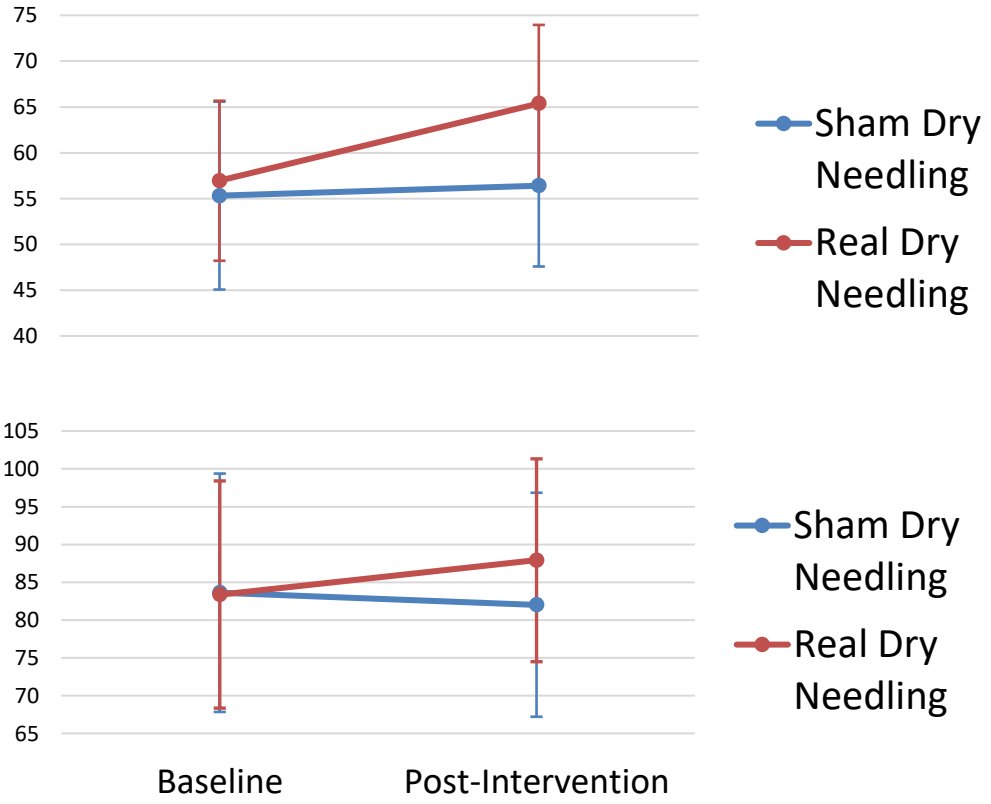
Shoulder Range of Motion

	Sham DN (n = 20)	Real DN (n = 20)
Shoulder IR		
Pre	55.3 ± 8.7	58.6 ± 10.3
Post	56.4 ± 8.6	65.4 ± 8.8

F(1,38) = 10.713, *p* = 0.002, with the *real DN group* having significantly increased IR.

	Sham DN (n = 20)	Real DN (n = 20)
Shoulder ER		
Pre	83.6 ± 15.0	83.4 ± 15.8
Post	82.0 ± 13.4	87.9 ± 14.8

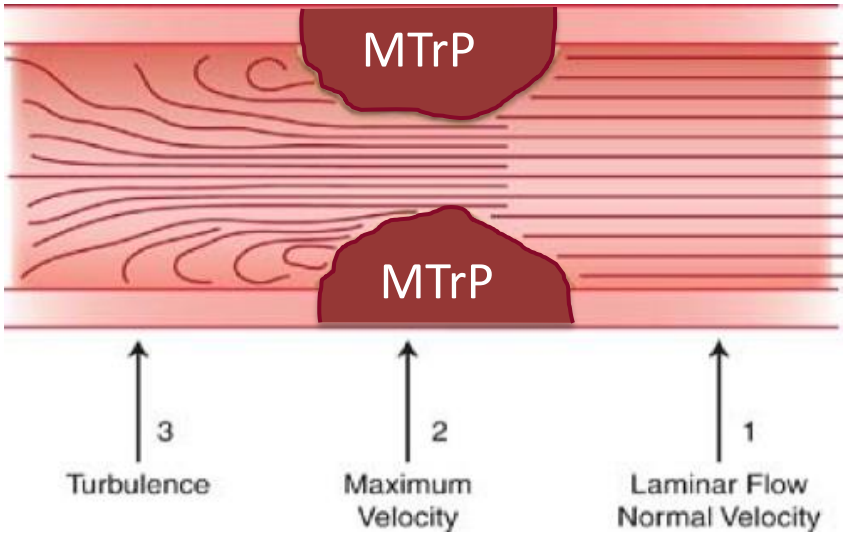
F(1,38) = 15.695, *p* < 0.001, with the *real DN group* having significantly increased ER.



Blood Flow: PSV

Decreases in PSV following DN could be attributed to two mechanism

- Removal of the taut band, improvements in muscle tone[12-16]
- Vasodilation[17-20]



Blood Flow: EDV, RI, PI

- Non-significant differences in EDV, PI, RI
  - EDV: Differs from prior literature: Increased EDV following DN
    - No abnormalities in EDV at baseline
    - Not classifying the type of MTrP (active vs. latent)[21]
  - PI: Differs from prior literature: Decreased PI following DN
  - Not classifying the type of MTrP (active vs. latent)[21]
  - RI: Differs from prior literature: Decreased RI following DN
    - RI = (PSV – EDV)/PSV

Adigozali et al., 2019; Sikdar et al., 2010

Range of Motion

- Significant increase in IR and ER ROM
  - Disruption of the taut band of sarcomere and restoration of motor end-plate activity[22]
    - Decreases in muscle stiffness or muscle tone[23-24]
    - Decreased electromyographic activity[12]

Conclusions

- Participants who received real DN exhibited a significant reduction in PSV indicative of an improvement in blood flow to the infraspinatus
- ROM assessments demonstrated a significant improvement in both ROM of shoulder IR and ER following real DN.

Limitations

- Generalizability to only those with low levels of pain and disability, but long-duration of symptoms
- Generalizability of shoulder ROM findings might be limited to the goniometric method and the joint position used in the study.
- Did not distinguish between types of MTrPs
  - Direction for future research.

Acknowledgements

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CENTER FOR STUDENT RESEARCH
TEXAS WOMAN'S UNIVERSITY

BaylorScott&White
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