


# Courage Kenny Rehabilitation Institute

## Dry Needling Evidence

Andrew Boldt, DPT, OCS, Cert DN  
Courage Kenny Sports & Physical Therapy


August 5, 2022

AllinaHealth 

1

## OBJECTIVES

- Background Information
  - History
  - Technique
- Physiological Response
  - Mechanical
  - Vascular
  - Neurophysiological
- Current Research Evidence
  - Recent Systematic Review and Meta-Analysis Studies
  - Recent Randomized Control Trials
  - Adverse Events
- Clinical Application
  - Summary of Research Evidence
  - Clinical Practice Recommendations

AllinaHealth 

2

2

## BACKGROUND

- History of Dry Needling:
  - Defined by the American Physical Therapy Association (APTA) as a skilled intervention that uses a thin filiform needle to penetrate the skin and stimulate underlying myofascial trigger points, muscular, and connective tissues for the management of neuromusculoskeletal pain and movement impairments. (1)
  - Initially researched and developed in the 1970's and 80's based off research of Dr. Janet Travell and Dr. David Simons (myofascial trigger point injections), Dr. Chan Gunn as well as Karel Lewitt (2,3)



McAfee D, Bagwell M, Falsone S. Dry Needling: A Clinical Commentary. *IJSPT*. 2022;17(4):551-555

AllinaHealth

3

## BACKGROUND

### Technique:

1. Palpation is utilized to identify a trigger point
  - Trigger point - tender/painful, taut band of muscle and when pressure is applied, should replicate the patient's familiar pain and location of symptoms
  - Patient's subjective feedback additionally confirms the specific treatment tissue location
2. Treatment location is prepped with alcohol wipe
3. A flat or pincer grip is used to localize the treatment site
4. Appropriate needle length is chosen to safely and appropriately reach the target tissue
5. Needle may be inserted superficially or deep into the target muscle tissue
6. Deep dry needling is completed with needle being pistoned back and forth in the muscle to replicate patient's familiar pain as well as to achieve a local twitch response
7. Obtain patient feedback throughout session
8. Needle is removed, pressure is applied as needed and patient response is assessed

AllinaHealth

4

## PHYSIOLOGICAL RESPONSE

### Mechanical:

Rapid depolarization after the needle physically produces a local twitch response which results in reduced pain and dysfunction at the local tissue (3)

Can immediately increase pressure pain threshold and range of motion, decrease muscle tone and pain in patients (4)

### Vascular:

Needling produces microtrauma to the dysfunctional muscle tissue (2)

Dysfunctional tissue may be relatively hypoxic from chronic tissue overload

Provokes a bleeding and inflammatory response, which locally increases growth factors, satellite cells and other substances that promote collagen repair and tissue healing (3, 5)

### Neurophysiological:

Needling can reduce both peripheral and central sensitization to pain (4)

Chronic pain may result in locally elevated neurotransmitters which dry needling with a local twitch response has been shown to reduce (4)

5

## PHYSIOLOGICAL RESPONSE

- Summary of Physiological Response:
  - Dry Needling *Physiological* Benefits:
    - Reduces local and referred pain
    - Decreases central sensitization
    - Improves tissue mobility
    - Promotes tissue healing
  - Dry Needling Practical *Clinical* Benefits:
    - ***By reducing pain and improving mobility, dry needling enables patients to more effectively participate with active exercise rehabilitation programs that are necessary to achieve their desired goals and outcomes***

6

# CURRENT RESEARCH EVIDENCE

## Systematic Review and Meta-Analysis:

Multiple recent systematic review and meta-analysis studies are available to summarize the current level of evidence concerning dry needling treatment with a variety of musculoskeletal diagnoses including the following:

- Plantar fasciitis / plantar heel pain
- Knee pain
- Lateral epicondylagia
- Shoulder pain / subacromial pain syndrome
- Chronic neck pain
- Dry Needling vs Corticosteroid Injection
- General musculoskeletal conditions



7

# CURRENT RESEARCH EVIDENCE

## Plantar Fasciitis / Plantar Heel Pain:

Journal of Pain Research

Dovepress

open access to scientific and medical research

Open Access Full Text Article

ORIGINAL RESEARCH

Effectiveness of trigger point dry needling for plantar heel pain: a meta-analysis of seven randomized controlled trials

- 7 RCT selected for inclusion
- Dry needling significantly reduced VAS scores compared to control groups at 1, 6 and 12 month follow-ups
- Incidents of adverse events was comparable in dry needling and control groups
- Functional outcome measures were not addressed (6)

Pain Medicine, 2021, 22(1), 1639-1641  
doi: 10.1093/pm/pnab174  
Advance Access Publication Date: 24 March 2021  
Review Article



### Is Dry Needling Effective for the Management of Plantar Heel Pain or Plantar Fasciitis? An Updated Systematic Review and Meta-Analysis

Luis Llorca-Almuzara, PT, MSc,\* Noé Labata-Lezaun, PT, MSc,\* Toni Meca-Rivera, PT,\*\*<sup>1</sup>  
Marcos J. Navarro-Santana, PT, MSc,<sup>1</sup> Joshua A. Cleland, PT, PhD,<sup>1</sup>  
César Fernández-de-las-Peñas, PT, PhD,<sup>1,2</sup> and Albert Pérez-Bellmunt, PT, PhD\*

- 6 RCT selected for inclusion
- Dry needling significantly reduced pain in short and long term, meeting the MCID for VAS on average foot pain
- Significant improvement in pain-related disability/function, however small effect size
- GRADE and Risk of Bias assessment indicate overall low level of evidence (7)



8

# CURRENT RESEARCH EVIDENCE

## Knee Pain:



Review

### Effects of Trigger Point Dry Needling for the Management of Knee Pain Syndromes: A Systematic Review and Meta-Analysis

Youssef Rahou-El-Bachiri<sup>1</sup>, Marcos J. Navarro-Santana<sup>2,3</sup>, Guido F Gómez-Chiguano<sup>4</sup>, Joshua A Cleland<sup>5</sup>, Ibai López-de-Uralde-Villanueva<sup>6</sup>, César Fernández-de-las-Peñas<sup>6,7,\*</sup>, Ricardo Ortega-Santiago<sup>6,7</sup> and Gustavo Plaza-Manzano<sup>4,8</sup>

- 10 RCT selected for inclusion
- Moderate effect size for dry needling reducing pain and improving related disability in the short term for patellofemoral pain but not in knee OA or post-surgery knee pain populations
- No long-term significant difference observed
- 5 of the 6 studies specific to patellofemoral pain combined needling with exercise and manual therapy – indicating need for multimodal approach
- Overall GRADE assessment of low to moderate (8)



## Lateral Epicondylalgia:



Original Article

### Effects of trigger point dry needling on lateral epicondylalgia of musculoskeletal origin: a systematic review and meta-analysis

Clinical Rehabilitation  
1-14  
© The Author(s) 2020  
Article reuse guidelines:  
sagepub.com/journalsPermissions  
DOI: 10.1177/026915520937448  
jcr.sagepub.com/home/ore  
SAGE

Marcos J Navarro-Santana<sup>1,2</sup>, Jorge Sanchez-Infante<sup>3</sup>, Guido F Gómez-Chiguano<sup>4</sup>, Joshua A Cleland<sup>5</sup>, Ibai López-de-Uralde-Villanueva<sup>6</sup>, César Fernández-de-las-Peñas<sup>6,7,\*</sup> and Gustavo Plaza-Manzano<sup>1,8</sup>

- 7 RCT selected for inclusion
- Large effect size for dry needling significantly reducing pain and related disability in short and long term as well as pain pressure threshold but only in short term when compared to control group
- Small effect size of improving strength compared to control group
- Overall GRADE and Risk of Bias assessment of low to moderate evidence (9)

9

# CURRENT RESEARCH EVIDENCE

## Shoulder Pain / Subacromial Pain Syndrome:



Review

### A Systematic Review of the Effectiveness of Dry Needling in Subacromial Syndrome

Maria Blanco-Díaz<sup>1</sup>, Rubén Ruiz-Redondo<sup>1</sup>, Isabel Escobio-Prieto<sup>2,\*</sup>, Marta De la Fuente-Costa<sup>1</sup>, Manuel Albornoz-Cabello<sup>2</sup> and José Casaña<sup>3</sup>

- 9 RCT selected for inclusion
- Most significant effects on pain and disability measures found when dry needling is combined with standard physical therapy
- Inconsistent effect between studies regarding range of motion of the shoulder
- Application of dry needling to the infraspinatus muscle produced most significant benefits (10)

PTJ: Physical Therapy & Rehabilitation Journal | Physical Therapy, 2021;10:1-11  
<https://doi.org/10.1083/ptj.2020.216>  
Advance access publication date December 19, 2020

Review



### Effects of Trigger Point Dry Needling for Nontraumatic Shoulder Pain of Musculoskeletal Origin: A Systematic Review and Meta-Analysis

Marcos J. Navarro-Santana, PT, MSc<sup>1,2</sup>, Guido F Gómez-Chiguano, PT, MSc<sup>3</sup>, Joshua A. Cleland, PT, PhD<sup>4,5,6</sup>, Jose L. Arias-Buria, PT, PhD<sup>7,8</sup>, César Fernández-de-las-Peñas, PT, PhD<sup>7,8,\*</sup>, Gustavo Plaza-Manzano, PT, PhD<sup>1,8</sup>

- 6 RCT selected for inclusion
- Small effect size for pain reduction in short term, but below MCID
- Large effect size for pain-related disability in the short and long term, at or exceeded MCID
- Overall low to moderate evidence level (11)



10

# CURRENT RESEARCH EVIDENCE

## Chronic Neck Pain:



Review

### Dry Needling in Physical Therapy Treatment of Chronic Neck Pain: Systematic Review

Manuel Rodríguez-Huguet<sup>1,2</sup>, María Jesús Vinolo-Gil<sup>1</sup> and Jorge Góngora-Rodríguez<sup>1</sup>

- 11 RCT selected for inclusion
- Positive outcomes for pain, range of motion and pain-related disability in short term and 3–6-month follow-up, limited significance in long term follow-up to 1 year
- Recommended treatment range of 4-6 sessions over 2-4 weeks
- Most beneficial treatment plan target the upper trapezius and levator scapulae, is preformed bilaterally and in combination with therapeutic exercise and other manual therapy techniques (12)

AllinaHealth

## Dry Needling vs Corticosteroid Injection:

Sousa Filho et al.  
Chiropractic & Manual Therapies (2021) 29:49  
<https://doi.org/10.1186/s12998-021-00408-y>

Chiropractic & Manual Therapies

SYSTEMATIC REVIEW

Open Access

### Corticosteroid injection or dry needling for musculoskeletal pain and disability? A systematic review and GRADE evidence synthesis

Luis Fernando Sousa Filho<sup>1,2</sup>, Marta Maria Barbosa Santos<sup>2</sup>, Gabriel Henrique Freire dos Santos<sup>2</sup> and Waldemir Monteiro da Silva Júnior<sup>2</sup>

- 6 RCT selected for inclusion
- Low quality evidence that there is no difference in short- or long-term pain or disability between dry needling and corticosteroid injection with greater trochanteric pain syndrome and myofascial pain
- Low quality evidence that corticosteroid injection is superior in the short term while dry needling is superior in the long term with plantar fasciitis and lateral epicondylitis (13)

11

# CURRENT RESEARCH EVIDENCE

## General Musculoskeletal Conditions:

PTJ: Physical Therapy & Rehabilitation Journal | Physical Therapy, 2021;1(01):1-15  
<https://doi.org/10.1083/ptj.2020.0170>  
Advance access publication date February 19, 2021

Review



### Is Dry Needling Applied by Physical Therapists Effective for Pain in Musculoskeletal Conditions? A Systematic Review and Meta-Analysis

Jorge Sánchez-Infante, PT, MSc<sup>1</sup>, Marcos J. Navarro-Santana, PT, MSc<sup>2</sup>, Alfredo Bravo-Sánchez, PT, MSc<sup>1</sup>, Fernando Jiménez-Díaz, MD, PhD<sup>1</sup>, Javier Abián-Vicén, PT, PhD<sup>1,3</sup>

- 42 RCT selected for inclusion
- 3 subgroups
  - Dry needling vs placebo
  - Dry needling vs other therapies
  - Dry needling + other therapies vs other therapies
- Low to moderate quality evidence of moderate to large effect size that dry needling was more effective treatment than no treatment, sham dry needling and other therapies at reducing pain at all follow-up time frames (from immediate to 24 weeks)
- Higher effect sizes were noted when dry needling was combined with other therapies at almost all follow-up time frames (14)

AllinaHealth

12

## CURRENT RESEARCH EVIDENCE

### General Musculoskeletal Conditions:

[ RESEARCH REPORT ]

ERIC GATTIE, PT, DPT\* • JOSHUA A. CLELAND, PT, PhD\* • SUZANNE SNOODGRASS, PT, PhD\*

The Effectiveness of Trigger Point Dry Needling for Musculoskeletal Conditions by Physical Therapists: A Systematic Review and Meta-analysis

JOURNAL OF ORTHOPAEDIC & SPORTS PHYSICAL THERAPY | VOLUME 47 | NUMBER 3 | MARCH 2017 |

AllinaHealth

- 12 RCT selected for inclusion
- Dry needling vs control/sham dry needling
  - Immediate to 12-week effects:
    - Low quality evidence suggesting moderate effect size favoring dry needling for reducing pain level
    - In only 2 studies were the effect sizes considered clinically meaningful
  - 12-to-24-week effects:
    - Moderate quality evidence suggesting small effect size favoring dry needling for reducing pain level
    - Low quality evidence suggesting small effect size favoring dry needling with functional outcome measures
- Dry needling vs other treatments
  - Immediate to 12-week effects:
    - Moderate quality evidence suggesting small effect size favoring dry needling for reducing pain level (4)

13

## CURRENT RESEARCH EVIDENCE

### Recent Randomized Controlled Trials:

- Knee pain
  - Dry needling quadriceps combined with stretching effectively reduced pain, improved function and improved VMO/VL ratio and coordination (15)
  - Dry needling the gluteus medius and quadratus lumborum when combined with exercise showed significantly greater effects on pain, function and pain pressure threshold when compared to exercise alone (16)
- Lateral Hip Pain / Hip OA
  - Short term (48 hours) improvement in pain, function and hip muscle force following 1 session of dry needling when compared to sham needling in patients with hip OA (17)
  - No difference in pain, function or medication intake at 6-week follow-up when comparing corticosteroid injection to dry needling in patients with greater trochanteric pain syndrome (18)
  - Dry needling with physical therapy vs physical therapy alone demonstrated significant improvement in pain and hip internal rotation range of motion in patients with hip pain (19)

AllinaHealth

14

## CURRENT RESEARCH EVIDENCE

- Recent Randomized Controlled Trials:
  - Shoulder pain / subacromial pain syndrome
    - Dry needling to the upper trapezius had a short term, significant and meaningful clinical difference in pain compared to sham needling, typically noted after 2 days following treatment (20)
    - Cervicothoracic and upper rib manipulation combined with dry needling resulted in greater reduction in pain, disability and medication intake when compared to non-thrust joint mobilization, soft tissue mobilization and interferential current in patients with subacromial pain syndrome (21)
  - Chronic neck pain / Cervicogenic headaches
    - Cervical and upper thoracic manipulation combined with dry needling resulted in significantly reduced pain and disability (exceeding MCID for VAS and NDI) compared to non-thrust mobilization and exercise in patients with cervicogenic headaches that was maintained at 3-month follow-up (22)
    - Dry needling when combined with standard physical therapy only showed a small effect size difference in pain at 1 month follow-up, but not 3 or 6 month, when compared to standard physical therapy including manual therapy and therapeutic exercises in patients with chronic neck pain (23)
    - Dry needling with manual therapy and exercise was not significantly different than sham dry needling with manual therapy and exercise at short- or long-term follow-up in patients with chronic neck pain
      - Both groups improved in pain level and disability measures (24)

AllinaHealth

15

## CURRENT RESEARCH EVIDENCE

### Adverse Events:

IJSPT

#### ORIGINAL RESEARCH ADVERSE EVENTS ASSOCIATED WITH THERAPEUTIC DRY NEEDLING

David Boyce, PT, EdD, OCS, ECS<sup>1</sup>  
Hannah Wempe, PT, DPT<sup>1</sup>  
Courtney Campbell, PT, DPT<sup>1</sup>  
Spencer Fuchino, PT, DPT<sup>1</sup>  
Edo Zylstra, PT, DPT, OCS<sup>2</sup>  
Grant Smith, PhD<sup>3</sup>  
Christopher Wingard, MS, PhD<sup>3</sup>  
Richard Jones, PT, DPT<sup>1</sup>

*The International Journal of Sports Physical Therapy* | Volume 15, Number 1 | February 2020 | Page 103  
DOI: 10.26603/ijsp.20200103


- Prospective questionnaire study design
- 420 physical therapist participated by reporting 20,464 total dry needling treatment sessions
- Responding physical therapist would document and report adverse events
  - Minor event: Bruising/hematoma, feeling faint, nausea, headache, drowsiness, bleeding at the needling site, needling pain during treatment, and aggravation of symptoms after treatment
  - Major event: Pneumothorax, punctured organ, broken/forgotten needle, systemic effects, infections, and altered symptoms
- 36.7% of treatment sessions resulted in minor events
  - Mainly bleeding, bruising and pain during treatment
- 0.1% of treatment sessions resulted in major events
  - Most common were prolonged symptom aggravation, fainting and forgotten needles
  - No pneumothorax or punctured organ reported (25)

AllinaHealth

16



## CLINICAL APPLICATIONS

- Summary of Research Evidence:
    - Generally low to moderate evidence with variable effect size to support the use of dry needling with a variety of musculoskeletal conditions
    - Most consistent significant finding with large effect associated with short term pain reduction
    - Increased significance of outcomes when dry needling is completed along with exercise and/or additional manual therapy interventions
    - Minor adverse events (bleeding, bruising and pain during treatment) are common but major adverse events are rare
    - Not recommended as a first-line or stand-alone treatment approach
  - Clinical Practice Recommendations:
    - Ensure patient is appropriate and no alternative manual therapy would be equally beneficial
    - Utilize as an adjunct treatment option as part of a multimodal, patient centered treatment plan
    - Patient education and communication before, during and following treatment is essential
    - **Goal when selecting dry needling as an intervention:**
      - Reduce pain and improve mobility
      - Improve patient tolerance and overall effectiveness of active exercise interventions
- AllinaHealth  Assist patient in achieving their desired goals and outcomes

17

## REFERENCES

- 1.) Description of Dry Needling In Clinical Practice: An Educational Resource Paper. APTA; 2013:1-72
- 2.) Kalichman L, Vulfsons S. Dry Needling in the Management of Musculoskeletal Pain. *The Journal of the American Board of Family Medicine*. 2010;23(5):640-646
- 3.) McAphee D, Bagwell M, Falsone S. Dry Needling: A Clinical Commentary. *International Journal of Sports Physical Therapy*. 2022;17(4)
- 4.) Gattie E, Cleland JA, Snodgrass S. The Effectiveness of Trigger Point Dry Needling for Musculoskeletal Conditions by Physical Therapists: A Systematic Review and Meta-analysis. *Journal of Orthopaedic & Sports Physical Therapy*. 2017;47(3):133-149
- 5.) Jacobson J, Chiavaras M. Ultrasound-Guided Tendon Fenestration. *Seminars in Musculoskeletal Radiology*. 2013;17(01):085-090
- 6.) He C, Ma H. Effectiveness of trigger point dry needling for plantar heel pain: a meta-analysis of seven randomized controlled trials. *Journal of Pain Research*. 2017;Volume 10:1933-1942
- 7.) Llorda-Almuzara L, Labata-Lezaun N, Meca-Rivera T, et al. Is Dry Needling Effective for the Management of Plantar Heel Pain or Plantar Fasciitis? An Updated Systematic Review and Meta-analysis. *Pain Medicine*. Published online March 24, 2021.
- 8.) Rahoo-El-Bachiri Y, Navarro-Santana MJ, Gómez-Chiguano GF, et al. Effects of Trigger Point Dry Needling for the Management of Knee Pain Syndromes: A Systematic Review and Meta-Analysis. *Journal of Clinical Medicine*. 2020;9(7):2044
- 9.) Navarro-Santana MJ, Sanchez-Infante J, Gómez-Chiguano GF, et al. Effects of trigger point dry needling on lateral epicondylalgia of musculoskeletal origin: a systematic review and meta-analysis. *Clinical Rehabilitation*. Published online June 23, 2020:026921552093746
- 10.) Blanco-Díaz M, Ruiz-Redondo R, Escobio-Prieto I, De la Fuente-Costa M, Albornoz-Cabello M, Casaña J. A Systematic Review of the Effectiveness of Dry Needling in Subacromial Syndrome. *Biology*. 2022;11(2):243
- 11.) Navarro-Santana MJ, Gómez-Chiguano GF, Cleland JA, Arias-Burúa JL, Fernández-de-las-Peñas C, Plaza-Manzano G. Effects of Trigger Point Dry Needling for Nontraumatic Shoulder Pain of Musculoskeletal Origin: A Systematic Review and Meta-Analysis. *Physical Therapy*. 2020;101(2)
- 12.) Rodríguez-Huguet M, Vinolo-Gil MJ, Góngora-Rodríguez J. Dry Needling in Physical Therapy Treatment of Chronic Neck Pain: Systematic Review. *Journal of Clinical Medicine*. 2022;11(9):2370
- 13.) Sousa Filho LF, Barbosa Santos MM, dos Santos GHF, da Silva Júnior WM. Corticosteroid injection or dry needling for musculoskeletal pain and disability? A systematic review and GRADE evidence synthesis. *Chiropractic & Manual Therapies*. 2021;29(1)

AllinaHealth 

18

## REFERENCES

- 14.) Sánchez-Infante J, Navarro-Santana MJ, Bravo-Sánchez A, Jiménez-Díaz F, Abián-Vicén J. Is Dry Needling Applied by Physical Therapists Effective for Pain in Musculoskeletal Conditions? A Systematic Review and Meta-Analysis. *Physical Therapy*. Published online February 19, 2021
- 15.) Ma YT, Li LH, Han Q, et al. Effects of Trigger Point Dry Needling on Neuromuscular Performance and Pain of Individuals Affected by Patellofemoral Pain: A Randomized Controlled Trial. *Journal of Pain Research*. 2020;Volume 13:1677-1686
- 16.) Zarei H, Bervis S, Piroozi S, Motealleh A. Added Value of Gluteus Medius and Quadratus Lumborum Dry Needling in Improving Knee Pain and Function in Female Athletes With Patellofemoral Pain Syndrome: A Randomized Clinical Trial. *Archives of Physical Medicine and Rehabilitation*. Published online August 2019
- 17.) Ceballos-Laita L, Jiménez-del-Barrio S, Marín-Zurdo J, et al. Effectiveness of Dry Needling Therapy on Pain, Hip Muscle Strength, and Physical Function in Patients With Hip Osteoarthritis: A Randomized Controlled Trial. *Archives of Physical Medicine and Rehabilitation*. Published online February 2021
- 18.) Brennan KL, Allen BC, Maldonado YM. Dry Needling Versus Cortisone Injection in the Treatment of Greater Trochanteric Pain Syndrome: A Noninferiority Randomized Clinical Trial. *Journal of Orthopaedic & Sports Physical Therapy*. 2017;47(4):232-239
- 19.) Jamaly A, Mohsenifar H, Amiri A. The Effects of Dry Needling in Combination with Physical Therapy on Improvement of Pain and Hip Internal Rotation Range in Patients with Piriformis Syndrome. *Journal of Clinical Physiotherapy Research*. 2018;3(3):118-122
- 20.) Pai MYB, Toma JT, Kaziyama HHS, et al. Dry needling has lasting analgesic effect in shoulder pain: a double-blind, sham-controlled trial. *PAIN Reports*. 2021;6(2):e939
- 21.) Dunning J, Butts R, Fernández-de-las-Peñas C, et al. Spinal Manipulation and Electrical Dry Needling in Patients With Subacromial Pain Syndrome: A Multicenter Randomized Clinical Trial. *Journal of Orthopaedic & Sports Physical Therapy*. 2021;51(2):72-81
- 22.) Dunning J, Butts R, Zacharko N, et al. Spinal manipulation and perineural electrical dry needling in patients with cervicogenic headache: a multicenter randomized clinical trial. *The Spine Journal*. Published online October 2020
- 23.) Steven FF, Ferreira GE, Wiebusch M, de Araújo FX, da Rosa LHT, Silva MF. Dry Needling Combined With Guideline-Based Physical Therapy Provides No Added Benefit in the Management of Chronic Neck Pain: A Randomized Controlled Trial. *Journal of Orthopaedic & Sports Physical Therapy*. 2020;50(8):447-454
- 24.) Gattie E, Cleland JA, Pandya J, Snodgrass S. Dry Needling Adds No Benefit to the Treatment of Neck Pain: A Sham-Controlled Randomized Clinical Trial With 1-Year Follow-up. *Journal of Orthopaedic & Sports Physical Therapy*. 2021;51(1):37-45
- 25.) Boyce D, Wempe H, Campbell C, et al. ADVERSE EVENTS ASSOCIATED WITH THERAPEUTIC DRY NEEDLING. *International Journal of Sports Physical Therapy*. 2020;15(1):103-113



19

## CONTACT INFORMATION

Andrew Boldt, DPT, OCS, Cert DN  
 email: [andrew.boldt@allina.com](mailto:andrew.boldt@allina.com)



20