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Research Article

Clinical Research Report of the Intricate Application of Dry Needling in Eliciting Trigger Points Local Twitch Response (TP-LTR) in the Upper Trapezius (UT) Region

Masahiro Takakura[1], Jessica Norton[2], Sharon Blaney[3] and Nicholas A Kerna[4,5]*

[1]*Seattle Nature Cure Clinic, Seattle, WA, United States*

[2]*Integrative Medicine Group, Seattle, WA, United States*

[3]*Bastyr University, Kenmore, WA, United States*

[4]*SMC-Medical Research, Thailand*

[5]*First InterHealth Group, Thailand*

***Corresponding Author:** Nicholas A Kerna, (mailing address) POB47 Phatphong, Suriwongse Road, Bangkok, Thailand 10500. Contact: medpublab+drkerna@gmail.com.

Received: January 04, 2021; **Published:** February 28, 2022

DOI: 10.31080/ecor.2022.13.00920

Abstract

Background: No past studies have examined the local twitch response (LTR) in the upper trapezius (UT), using multiple needles with manipulation. Prior and published research studies have focused primarily on a single-needle approach.

Purpose: This study was designed and performed to collect data on the LTR and its relationship to the number of (acupuncture or dry needling) needles that create biotensegrity tension in neuro-myofascial dynamics (to ultimately bring about relief from UT tension and related symptoms).

Methods: Data were gathered from qualified clinic patients and volunteers from a study population. All selected study participants were experiencing increased upper trapezius (UT) tension and pain or discomfort in the UT region. Certified practitioners located possible trigger points (TPs) by palpation. Treatment procedures—utilizing Ashi points—were applied. The subsequent data were evaluated to determine the most efficacious number and size of needles in effecting biotensegrity tension in neuro-myofascial dynamics and the subjects' release or relief from UT tension.

Results: Based primarily on pre-treatment and post-treatment interviews and questionnaires, the results were analyzed using statistical bar graphs (tables). Primary data utilized determined the following. The average number of needles used was 3.15 for the right side and 2.73 for the left side. The average thrusts were 18 for the right side and 12.9 for the left side. The average number of 90-degree twists was 0.5 for the right side and 0.8 for the left side. The average number of 180-degree twists was 18.4 for the right side and 12.05 for the left side. The average duration of relief was 5.475 days, and the average duration of soreness was 16.2 hours.

Conclusion: Specific results of this study depicted a 3-D neuro-myofascial dynamics matrix using multiple needles, multiple thrusts and twists, and multiple LTR locations. These results demonstrated that overall and on average, multiple needling with larger gauge needles (based on participants' tolerances) was more effective in reducing UT tension and associated symptoms (and longer-lasting relief) than the more conventional and utilized one-needle protocol.

Keywords: *Acupuncture; Anti-Inflammatory; Biotensegrity; Dry-Needling; Manipulation; Motor Points; Neuro-Myofascial*

Abbreviations

CITI: Collaborative Institutional Training Initiative; CRP: C-Reactive Protein; DN: Dry Needling; EHR: Electrical Health Record; ESR: Erythrocyte Sedimentation Rate; IMS: Inter-Muscular Stimulation; LTR: Local Twitch Response; SC: Sternoclavicular; T&T: Thrust and Twist; TP: trigger point; UT: Upper Trapezius

Introduction

This study was designed and performed to collect data on the local twitch response (LTR) and its relationship to the number of needles that create biotensegrity tension in neuro-myofascial dynamics. This research determined that the most significant benefit of the LTR effect to neuro-myofascial dynamics of trigger points (TPs) is achieved by using multiple needles with manipulation. No past studies have investigated LTRs using multiple needles with manipulation. This multiple needling with manipulation technique can create the neuro-myofascial dynamic, inducing LTRs.

Recruitment was minimal; subjects were selected from individuals presenting with upper trapezius (UT) tension TPs identified by manual palpation. While some studies have disregarded the necessity of the elicitation of an LTR to identify the most effective TP [1–3], a recent study by Hakim., *et al*. (2019), "The Effect of Dry Needling on the Active Trigger Point of the Upper Trapezius Muscle: Eliciting Local Twitch Response on Long-Term Clinical Outcomes", showed that—after treatment—significantly higher changes with pain, pain pressure threshold, and active cervical lateral flexion were observed in the LTR group compared to the control group without an LTR [4].

Since the upper trapezius TP area is slightly more common than other loci, multiple LTRs—using multiple needles with manipulation—can be the best way to observe the effect of dry needling to release the upper trapezius muscle.

Objectives of the Study

This research aimed to determine if multi-needle therapy is more efficacious than single-needle application for reducing UT tension and related pain. Moreover, it aimed to ascertain if a 3-D neuro-myofascial dynamic matrix—using multiple needles, multiple thrusts and twists (Ts&Ts), and multiple LTR loci—is preferable to a 2-D matrix model. This research was deemed worthwhile since TP areas are wide bands, and previously published studies employed only one needle in contrast to multiple needles used in this study.

Methods

Population

The sample population consisted of patients who presented to the clinic for treatments—all of them presenting with various conditions and symptoms. The inclusion criteria were those experiencing significant UT tension and pain or discomfort in the UT region. Exclusion criteria included complaints or pain unrelated to UT trigger trigger points. This study did not include the cranial, cervical, or upper thoracic spine region.

Since TPs can occur in any part of the body with skeletal muscles [5–7], the focus of this study was to explore the relationship between the number of needles required to induce an LTR, while evaluating other factors. The UT region is one of the most often affected muscular regions with TPs, affecting a large population [8,9].

Study design

The study design provided treatment for TPs located in the shoulder, specifically the upper UT region. An increase in muscle tension can be differentiated by primary or secondary tension created in the neuro-myofascial system. Primary UT trigger points commonly origi-

nate from an injury to the UT muscle [10,11] in whiplash, concussion, acromioclavicular injury, or postural alignment issues (involving the UT).

The cervical spine is often related to heightened UT tension due to reverse cervical lordosis, occipital weight, and torsion or misalignment of the upper thoracic spine [12,13]. UT trigger points that originate from secondary factors are frequently associated with stress, adversely affecting the accessory nerve (CN XI), injury to the neck or shoulder—such as sternoclavicular (SC) injury, cervical spine disc pathology, postural alignment issues, involving increased upper thoracic kyphosis, and upper cross syndrome [14–16].

Data were collected from volunteers and patients. The variables collected included age, race, gender, chief complaint, intake of anti-inflammatory supplements or drugs, types of needles, number of needles on locations, number of LTRs at each location, number of thrusts at each location, either 90-degree or 180-degree twist at each location, the stress in life, diet, and duration of the treatment effect.

Possible TPs were identified with the patient seated and then prone. TPs were located by employing precise practitioner palpation. The practitioner performed this procedure with the palpation hand remaining over the TP locations.

The data collection sheet was distinct from the Electrical Health Record (EHR); however, the needling treatment procedure was noted on the treatment plan in the EHR. No identifying information was included in the data collection sheet.

Follow-up included an in-office visit or a phone call to the study participants. The study population were asked to report the number of days of relief they experienced from the treatment.

Procedures and protocols

The procedure began with intake. Some of the subjects were established patients who came to the clinic seeking treatment for their chief complaints, while others were volunteers. If the proposed participant indicated that they were experiencing musculoskeletal issues related to the cervical spine or neck region, they were inclusion candidates. Patient data were collected if TP needling was determined to be the most suitable treatment.

While completing subjective intake and recording objective findings, the practitioner considered a diagnosis and appropriate treatment options. The practitioner discussed the needling procedure with the study participant when UT needling was indicated. The participants were made aware of the treatment goal to relieve tension in the UT (to alleviate pain or discomfort related to hypertonic UT). The participants were also informed of the possible side effects of the proposed treatment, such as soreness, bruising, and pain. Each participant gave verbal consent to receive treatment, including needling on the UT.

- The UT trigger point was located by palpation with the subject seated, then palpated again while the subject was prone. TPs were located by the practitioner applying fingers equal distance from medial to lateral at 4 points.
- All TPs were located after precise palpation and needling, while the palpation hand was kept in position to keep track of the location.
- Possible TP locations were noted by the numerals 0.5, 1, 1.5, 2, 2.5, 3, 3.5, 4, 4.5, 5.5, 6, 6.5. Posteriorly, there are 12 points, and 5 base locations (numbered 1, 2, 3, 4, 6) posteriorly (Figure 1).

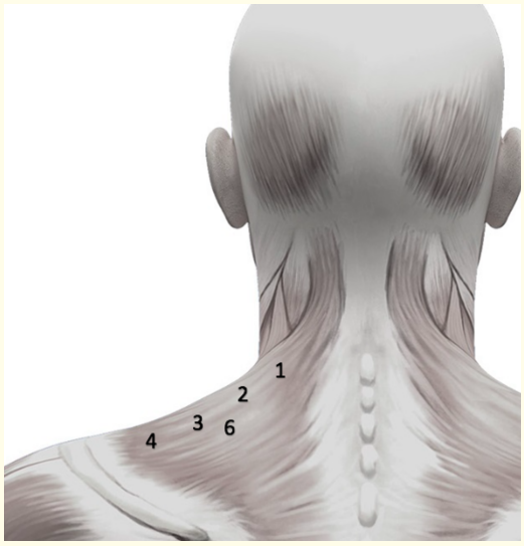

Figure 1: *Acupuncture Ashi point needling locations on the posterior upper trapezius muscle.*

Anterior locations are numbered 7.5, 8, 8.5, 9, 9.5, and 2 base locations (numbered 8 and 9) anteriorly as reference (Figure 2).

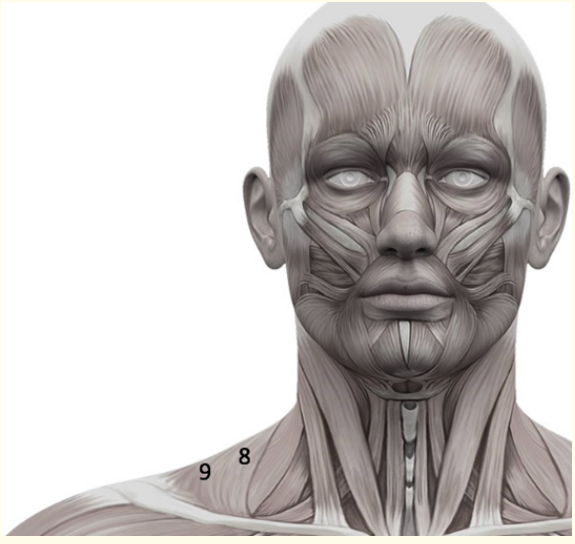

Figure 2: *Acupuncture Ashi point needling locations on the anterior upper trapezius muscle.*

Half-way points were included, and 17 locations were palpated and examined. Even though Simons has mapped UT trigger points [17] and Callison has mapped motor points [18], it was deemed essential to palpate and observe the TPs (Figure 3).

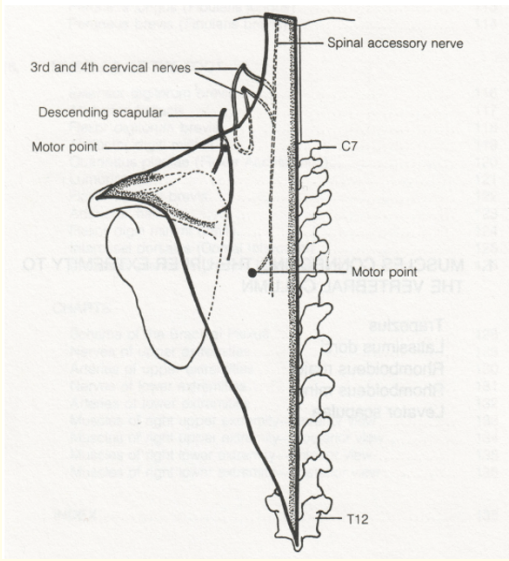

Figure 3: *Motor point locations on trapezius by Warfel (1997), comparing locations to Figures 1, 2. Adapted from Warfel JH. The Extremities, Muscles and Motor Points. Lippincott Williams & Wilkins; 1993.*

Once the most indicated TP was located, the needle selection followed. Even though inter-muscular stimulation (IMS) and dry needling (DN) use larger gauge size needles, such as a 30 mm in length and 0.18 mm to 0.22 mm gauge diameter, this study utilized 30 mm in length and 0.12 mm (Serin J type No. 02, made in Japan) to 0.16 mm (DBC, made in Korea) gauge diameter needles.

Needle selection was dependent on the patient's condition. There was no absolute guideline regarding needle selection. If a participant was suffering from acute pain, then a smaller gauge needle was utilized to minimize the pain response from the needle insertion and LTR—since LTRs can evoke a significant sensation for the patient, similar to a wave in the muscle that is created by an internal punch. If a patient could tolerate the LTR, the needle was thrust and twisted to create biotensegrity tension in the neuro-myofascial dynamic, eliciting a greater LTR.

Note that a practitioner needs to be extremely careful not to over-stimulate. If TPs are overstimulated, soreness can persist for a few days and may decrease the TP needling release effect [19,20]. If a patient was suffering from chronic, severe pain—due to a UT trigger point—a larger diameter needle was utilized to have more LTRs, and release. To reiterate, the number of LTRs depended on the participant's LTR tolerability.

Other factors involved in needle selection were the state of the patient, the muscle fiber, and the amount of biotensegrity and neuro-myofascial dynamic tension in the UT (created by the manipulation of the needles):

- The patient's state refers to how the participant was feeling at the treatment time. If they were sensitive emotionally, mentally, and physically, the 0.12 mm needle was chosen. Also, if they noted sensitivity to needles, 0.12 mm needles were chosen.
- The muscle fiber state indicates whether the body was already stressed and tensed. In such a scenario, UT trigger points were already taut and rigid, and larger gauge needles were unnecessary. At 0.12 mm gauge, the smallest needle would LTR provocative.

Needle gauge selection was straightforward if palpation was focused on finding the TPs. While palpating, the LTR would have been noticeable to the practitioner, demonstrating that the participant's body was already stressed, and UT trigger points were uncomplicated to release with a smaller gauge needle.

- A sufficient amount of biotensegrity tension in the UT region—to induce an LTR—could be problematic to identify. Determination (of biotensegrity tension) was by inserting the first needle into the tissue at a 90-degree angle (Figure 4 and Figure 5).

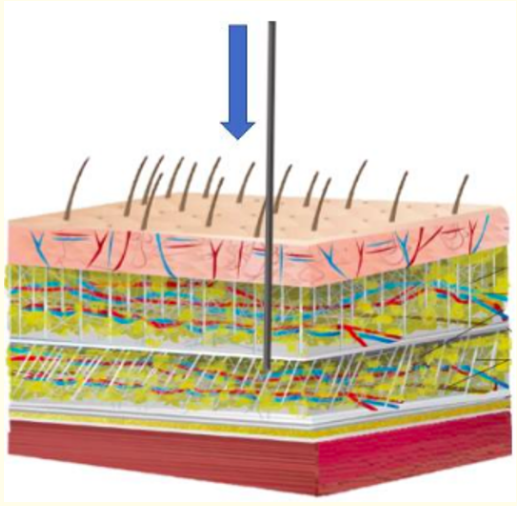

Figure 4: *Depiction of needling: needle insertion is at a 90-degree angle to the angle of the tissue.*

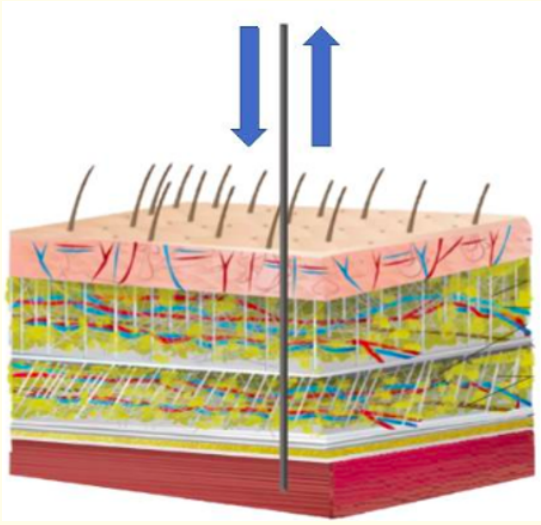

Figure 5: *Needle manipulation: depiction of the thrusting motion of a needle.*

Sometimes, the needle angle was modified to create more tension. After the first needle was applied, the practitioner thrust and twisted—if an LTR was not experienced by the subject. If there was no build-up of tension on the needle, then the second needle needed to be of a larger gauge to obtain more tension in neuro-myofascial dynamics—with the practitioner making sure to ask if the participant could tolerate the larger gauge needles.

If a participant could not tolerate a larger gauge needle, a continued application—using the 0.12mm gauge needle—was employed, with repeated thrusting and twisting to create maximum biotensegrity tension in neuro-myofascial dynamics (Figure 6 and 7).

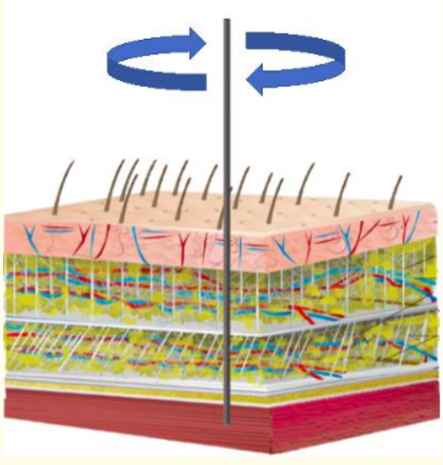

Figure 6: *Needle manipulation: depiction of the twisting motion of a needle.*

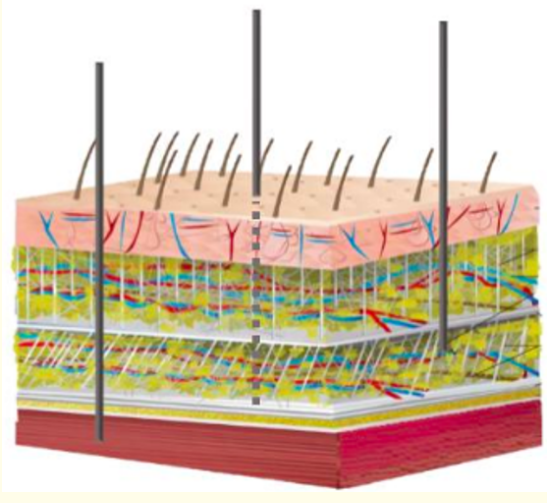

Figure 7: *Multiple needles to depict biotensegrity in 3-D by having 3 needles pulling tension in neuro-myofascial dynamics after thrusting and twisting manipulation of needles.*

The needle manipulation is described in two steps: thrust and twist. Thrust is a piston-like motion of needling into a deeper tissue layer from a more superficial layer or a deeper tissue layer out to a more superficial layer—depending on the depth of the location of the UT trigger points. The needles are twisted 90 degrees or 180 degrees, augmenting biotensegrity tension in the neuro-myofascial dynamics. The maximum thrusting was 15—considering a study by Domingo (2013), which concluded that 15 repetitive puncturings in a muscle do not interrupt muscle regeneration and reinnervation [21].

Study population (demographics)

The subjects in this study ranged from 25 to 57 years. There were 3 males and 17 females, comprising a multi-racial group of 15 Caucasians, 2 African Americans, 2 Asians, and 1 Middle-Easterner. Three subjects were taking anti-inflammatory supplements, such as fish oil or turmeric.

Most patient complaints were neck or shoulder pain, or neck or shoulder tension. Six subjects had never undergone acupuncture Ashi trigger-point release on the upper trapezius muscles. Only one subject had needling on their right side due to a unilateral complaint.

Results

- The average number of needles used was 3.15 for the right side and 2.73 for the left side.
- The average number of LTRs was 4.43 for the right side and 3.23 for the left side.
- The average thrusts were 18 for the right side and 12.9 for the left side.
- The average number of 90-degree twists was 0.5 for the right side and 0.8 for the left side.
- The average number of 180-degree twists was 18.4 for the right side and 12.05 for the left side.
- The average stress level (on a scale of 0–10, with 10 as the highest) was 6.225.
- Most subjects reported having less than 8 hours of sleep per night, which typically provokes or exacerbates inflammation and, thus, slightly skewing this study's interpretation of results. Sleep deprivation or lack of adequate sleep adversely affects the immune response and inflammation [22,23].
- Needles of 0.12-mm diameter were used for 6 subjects, and 0.16-mm diameter needles were used for 14 subjects.
- One subject experienced no relief from the treatment.
- The average duration of relief was 5.475 days, and the average duration of soreness was 16.2 hours.
- After the treatment, some participants experienced no soreness, and 1 subject experienced soreness for 48 hours (Table 1).
- Three needles were most commonly used bilaterally, and 1 subject had 7 needles inserted on the right side (Table 1).
- The most common location of an LTR was 2 on the right and 3 on the left—followed by 3 on the right and 2 on the left.
- There were several LTRs in the 5th position, also on the right side (Table 2).
- Most of the subjects had a total of 1–4 LTRs, and one subject had 20 LTRs on the right side (Table 3).
- Most subjects had 3 LTRs, while others had 2, 4, and 5 LTRs (Table 4).

- Slightly more than half of the subjects had one LTR location bilaterally, and slightly less than half had two LTR locations.
- One subject had 3 LTR locations on the left side (Table 5).
- The most common needling order showed, for the right side, first: 3; second: 2, 3, or 4; third: 2 or 4; for the left, side first: 3 or 2, second: 2, 3, or 4, third: 1, 2, or 4 (Table 6).
- There was no correlation between the LTR and the number of thrust sand twists.
- A 180-degree twist was used most, and the number of Ts&Ts was almost the same for both right and left sides (Tables 1 and 2).

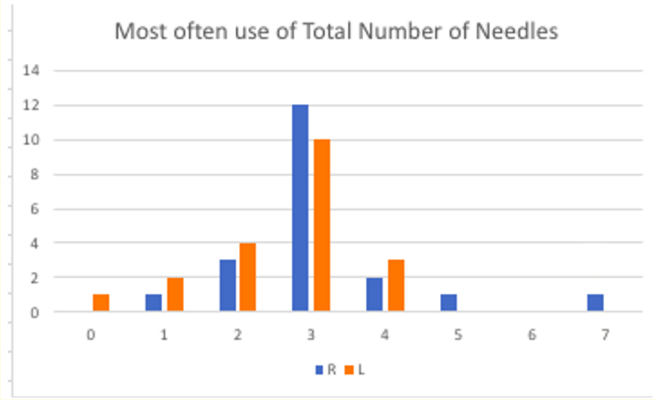

Table 1: *Horizontal column numbers indicate the needle insertion location on the upper trapezius from 0-7; vertical column numbers indicate the number of subjects treated.*

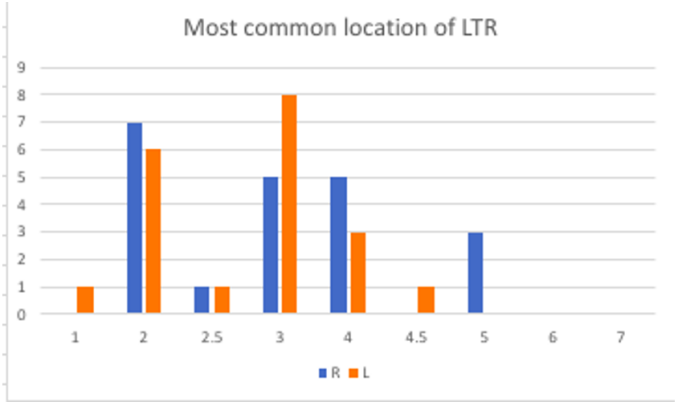

Table 2: *Horizontal numbers indicate the needle insertion location on the upper trapezius from 0-7; vertical numbers indicate the number of LTRs.*

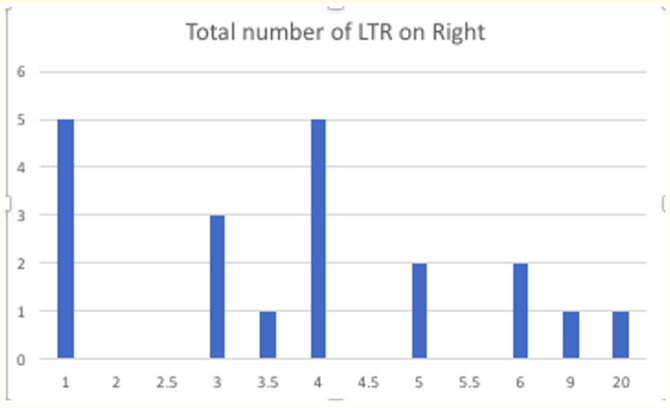

Table 3: *Horizontal numbers indicate the number of LTRs on the right upper trapezius with needle insertion and manipulation; vertical numbers indicate the number of subjects treated.*

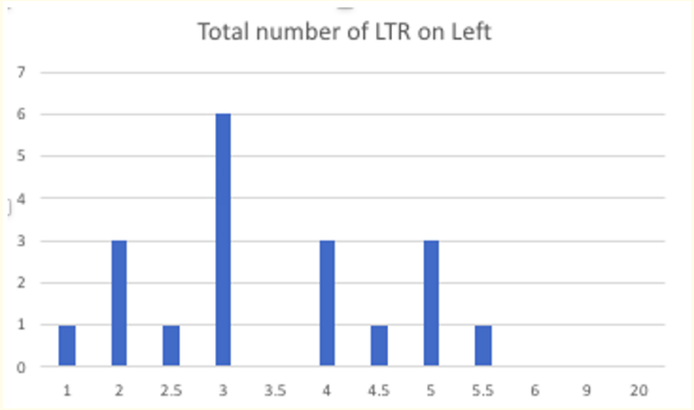

Table 4: *Horizontal numbers indicate the number of LTRs on the left upper trapezius with needle insertion and manipulation; vertical numbers indicate the number of subjects treated.*

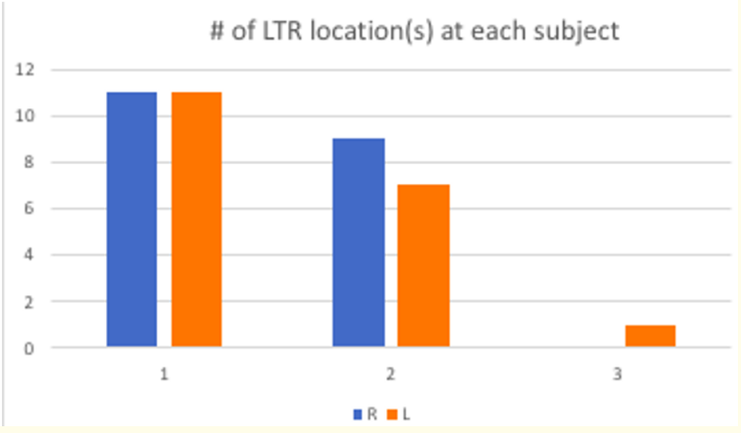

Table 5: *Horizontal indicates the number of LTRs locations; vertical numbers indicate the number of subjects treated.*

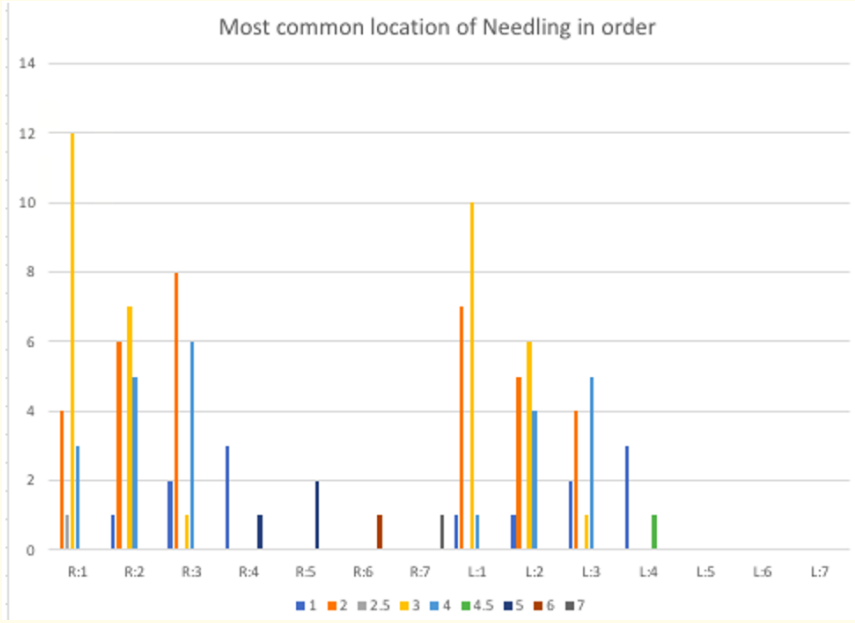

Table 6: *Horizontal numbers indicate the location of the needle insertion and colors show; vertical numbers indicate the number of subjects; colors indicate the order in which needling was performed, from 1–7.*

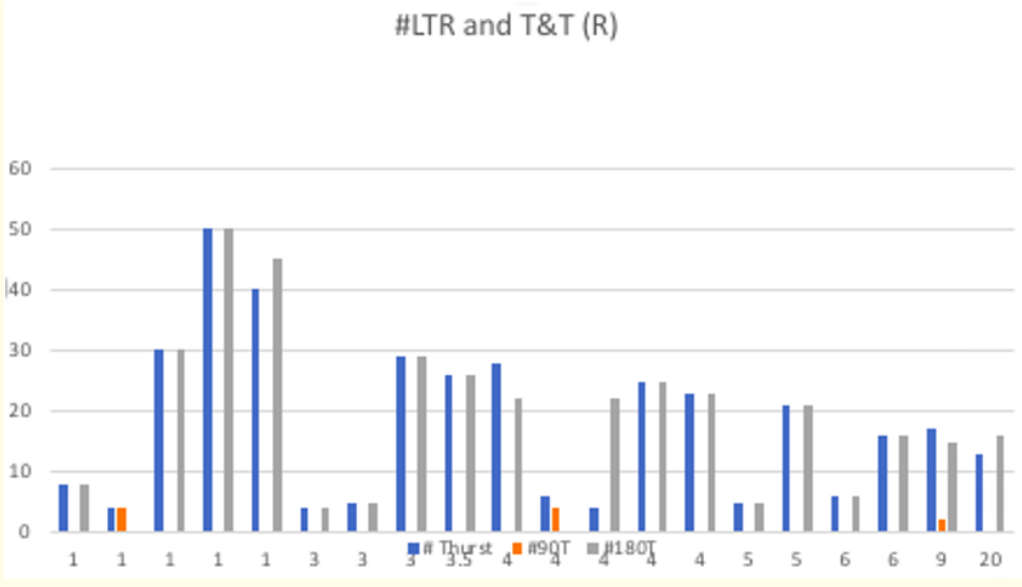

Table 7: *Total number of LTRs and needle manipulations on the right upper trapezius; horizontal numbers indicate the number of LTRs; vertical numbers indicate the total number of thrusts and twists. Colors: blue indicates the number of thrusts, orange indicates 90-degree twists, gray indicates 180-degree twists.*

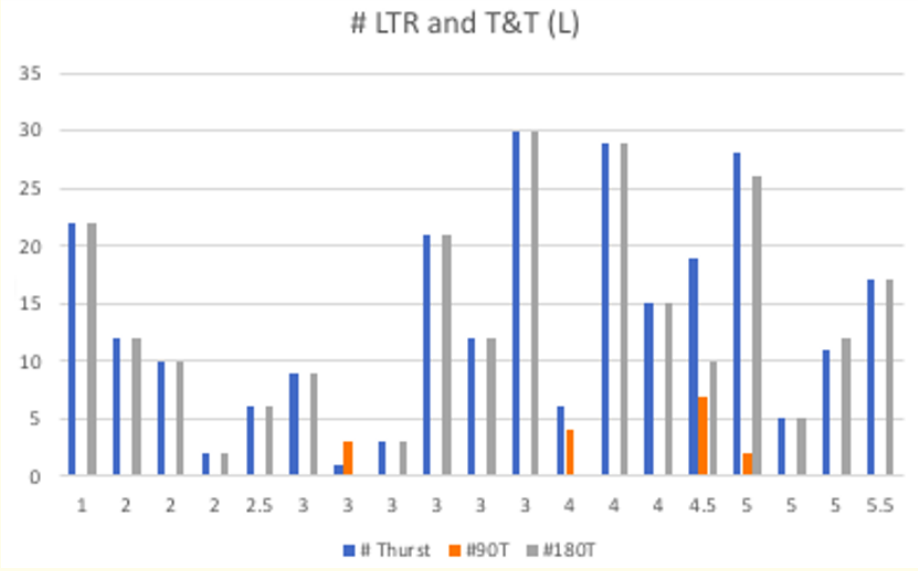

Table 8: *Total number of LTR and needle manipulations on the right upper trapezius; horizontal numbers indicate the number of LTRs; vertical numbers indicate the total number of thrusts and twists. Colors: blue indicates the number of thrusts, orange indicates 90-degree twists, gray indicates 180-degree twists.*

Discussion

This section reports the number of LTRs (neuro-myofascial dynamic) created by the number of needles related to various factors:

- All subjects experienced relief of tension and pain in the shoulder.
- The average time of relief was 5.58 days. Physically, all subjects had shoulder and neck tension before the treatment.
- The study shows that acupuncture Ashi trigger-point needling is an effective treatment method for reducing physical tension (Tables 1–3).

An overall decrease in physical tension correlated with a perception of a decrease in pain and tension was noted. Even though more than half of the subjects experienced soreness (average of 15.7 hours) after the procedure, the treatment goal was achieved. (The correlation between other factors, such as age, the total number of LTRs, and needle size, was not observed but was not statistically significant). The study's results were limited due to the relatively small sample size of the subject pool and the range of factors to measure.

In the future, more diverse recruitment would be essential to obtain an equal ratio of male and female subjects and diverse ethnic backgrounds. It would also be beneficial to gather subjects from different cultures by possibly doing a multi-center study in a range of countries.

- Clinically, Japanese patients reported less pain than their American counterparts. Not only might this pain-perception difference be a cultural difference, but also a dietary difference.
- Nine subjects, all Americans, were limiting or eating low amounts of dairy because they either had a sensitivity or allergy to dairy products or knew that consuming such products could cause an inflammatory response.
- No subjects were taking any anti-inflammatory medication; clinically, anti-inflammatory medications are also related to an LTR.

LTRs occur less frequently in patients on anti-inflammatory drugs [24]. Incidentally, performing blood tests, such as C-reactive protein (CRP) and erythrocyte sedimentation rate (ESR) [25], might indicate a possible relationship between an LTR and inflammation.

Specific results of this study depicted a 3-D neuro-myofascial dynamics matrix using multiple needles, multiple T&T, and multiple LTR locations.

Past studies have used only one needle or injection site even though the complexity of the LTR—in that it is not only one area that is less than 1 mm in size; rather, trigger-point areas are wide bands embedded in the nervous, muscle, and fascia systems [14,19,26].

It is opined that the 3-D approach is preferable to a 2-D approach, and should be considered when treating trigger points. Soreness post-treatment needs to be further evaluated and performed via microdialysis study with multiple LTRs and needles. T&Ts could potentially explain the soreness.

It was interesting that most subjects had greater than 5/10 severity regarding stress. These results should be compared with a group of subjects that have less stress. Moreover, stress should be further evaluated and categorized as physical or emotional. Other results are noted as follows:

- Every subject experienced relief from trigger-point acupuncture Ashi dry-needling treatment.
- The maximum relief time was 14 days.
- Some subjects had no soreness, and others had soreness for a maximum of 72 hours (See Table 1 preceding).

Conclusion

Specific results of this study investigated a 3-D neuro-myofascial dynamics matrix employing multiple needles, multiple T&T, and multiple LTR loci. These results identified the following constitutional conclusion. Principally, the mean data indicated that multiple needling with larger gauge needles (based on subjects' tolerances) was more useful in ameliorating UT tension and allied symptoms (and provided longer-lasting relief) than the more typical and practiced one-needle application.

Conflict of Interest Statement

The authors declare that this paper was written without any commercial or financial relationship that could be construed as a potential conflict of interest.

Supplementary Note 1

The principal investigator, (Masahiro Takakura, Ph.D., N.D., LAc, D.C., collected the data. Dr. Takakura is a certified practitioner, receiving Collaborative Institutional Training Initiative (CITI) training through Bastyr University, Kenmore, Washington, United States, by completing "Human Subjects Research, Biomedical Research".

Supplementary Note 2

This paper is based on prior doctoral research: Takakura M. (2019). "The Observation of the Complexity of Trigger Point Local Twitch Response (LTR) within Neuro Myofascial Dynamics by Upper Trapezius Acupuncture Ashi Needling" (unpublished doctoral dissertation).

Acknowledgments

The authors are grateful to Kinesio Taping® for providing certain supplies and for their assistance in co-creating Figures 1, 2, 4–7, and to JH Warfel (author) and Lippincott Williams and Wilkins (publisher) for Figure 3, which was adapted from *The Extremities, Muscles and Motor Points*; 1993.

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