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Review Article

Local Twitch Response (LTR) as an Indicator of Trigger Point (TP) Needling Therapy Success Regarding Upper Trapezius (UT) Muscle Spasms, and TP's Efficacy Compared to Diverse Modalities in Addressing UT Muscle Spasm

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Abstract

This systematized review sought to better qualify and quantify the causal relationship between trigger-point (TP) needling efficacy and the local twitch response (LTR) regarding the upper trapezius muscle.

A systematized review is defined by the Duke University Medical Center Library and Archives as an attempt to include elements of the systematic review process while stopping short of a conventional systematic review.

The limited data utilized showed, preliminarily, that an LTR from needle insertion is a relative indicator of treatment success—as determined using a Visual Analogue Scale and measuring the patients' ranges of motion, pre-treatment and post-treatment.

This review also noted that an LTR is a probable prerequisite for identifying effective TPs and a helpful hallmark in treating patients, resulting in peak benefit. However, this procedure can cause post-treatment, needling application-area tenderness.

Novel research should consider the number of LTRs resulting in dry needling (DN) maximal benefit at a specific TP. Finally, it is noted that utilizing 0.12 mm needles inhibits muscle soreness, mitigates patient anxiety concerning needling, and enhances needling therapy efficacy—as indicated in the comparison studies.

Keywords: *Anxiety Disorder; Muscle Tension; Myofascial Pain; Neck, Shoulder, and Upper Back Pain; Needling Treatment*

Abbreviations

DN: Dry Needling; ESWT: Extracorporeal Shockwave Therapy; HPPTUS: High-Power Pain Threshold Ultrasound; LTR: Local Twitch Response; NCBI: National Center for Biotechnology Information; QoL: Quality of Life; RCT: Randomized Control Trial; ROM: Range of Motion; RT-AJ: Range of Tragus-Acromioclavicular Joint; TP: Trigger-Point; US: Ultrasound; VAS: Visual Analog Scale

Introduction

In "A Systematic Review and Meta-Analysis of the Effectiveness of Dry Needling for Myofascial Trigger Points Associated with Neck and Shoulder Pain" by Liu., *et al*. (2015), a local twitch response (LTR) was not observed in subjects receiving trigger-point (TP) needling [1].

A study by Kietrys., *et al*. (2013)—titled "Effectiveness of Dry Needling for Upper-Quarter Myofascial Pain: A Systematic Review and Meta-Analysis"—noted studies describing whether or not an LTR was desired or elicited by dry needling (DN) [2]. Based on most of the studies reviewed, these investigators opined that LTR provocation was necessary for the DN technique [2]. However, Hong (1994) detected only a slight difference between an LTR with TP injections and no LTR with TP injections [3].

LTRs are critical in identifying TPs and necessary in treating patients, resulting in maximum benefit. However, this procedure can cause post-treatment soreness [3].

Needling treatments—either wet or dry—can cause soreness and, at times, heightened tension in the patient and specific muscles due to pain reactions. Also, needling can cause an anxiety reaction in the patient. Thus, extracorporeal shock wave therapy (ESWT) or high-power pain threshold ultrasound (HPPTUS) therapy can be beneficial, avoiding soreness and diminishing anxiety caused by needle insertion. The ESWT and HPPTUS techniques are forms of sound-wave therapy.

Study design

A systematized review is defined by the Duke University Medical Center Library and Archives includes elements of a systematic review as a truncated and less comprehensive version of a substantive systematic review [4].

Data source: inclusion and exclusion criteria

The systematized review for this research was conducted by the Assistant of Librarians from Bastyr University, Kenmore, Washington, USA. The publication search for the data sources was accessed through the National Center for Biotechnology Information (NCBI) and Embase.

The search terms were adapted for a comparative study, using the following search words and terms: trigger points and superficial back muscle, acupuncture, massage, extracorporeal shockwave therapy, high-power pain threshold ultrasound therapy, myofascial pain syndrome, stretching, and yoga.

Studies that included the following terms were used: 1) randomized control trial (RCT), 2) comparative study, 3) patients with myofascial pain syndrome (associated with neck, shoulder, or superficial back muscle pain), 4) identifying trigger points, and 5) performing treatments.

Only studies employing TP needling were considered. Modalities, such as ESWT, HPPTUS, other forms of electrotherapy were not included in this study.

Selection and data extraction

According to the inclusion and exclusion criteria, the principal investigator evaluated titles and abstracts of selected studies. The data extracted included population sample size, number of male and female patients, population's mean age, symptoms duration, diagnoses, LTR, and outcome measurements.

Results

The readily accessible research suggested that limited studies have been designed and undertaken to evaluate treatment modalities on the upper trapezius muscles specifically.

For this research, 19 studies were reviewed and selected based on the size of the subject pool, mean age, target tissue, diagnosis, LTR, outcome measures, and results. The selected studies are as follows:

- Itoh., *et al*. (2007) [5]
- Sarrafzadehm., *et al*. (2012) [6]
- Patra., *et al*. (2017) [7]
- Unalan., *et al*. (2011) [8]
- Gur., *et al*. (2014) [9]
- Bubnov., *et al*. (2011) [10]
- Segura-Orti., *et al*. (2016) [11]
- Kashyap., *et al*. (2018) [12]
- Amini., *et al*. (2017) [13]
- Aguilera., *et al*. (2009) [14]
- Kamali., *et al*. (2019) [15]]
- Ustun., *et al*. (2014) [16]
- Aridici., *et al*. (2016) [17]
- Gur., *et al*. (2013) [18]
- Kamanli., *et al*. (2005) [19]
- Ay., *et al*. (2010) [20]
- Koca., *et al*. (2014) [21]
- Bookwala., *et al*. (2015) [22].

Discussion

Only 3 of the 19 studies reviewed elicited an LTR with the application of DN. However, 3 LTP-positive subjects experienced significantly decreased pain, using the Visual Analog Scale (VAS), and increased overall range of motion (ROM). Nevertheless, no studies noted, quantified, or qualified the number of LTRs elicited in each subject or needle manipulation by the physician or therapist.

Summary of TP needling's success compared to other modalities and procedures in relieving UT muscle spasm

Tables 1–3 clearly illustrate TP needling's superiority compared to other conventional modalities regarding UT muscle spasm treatment—noting, as mentioned earlier, the LTP response indicates effective TP placement and protocol. The lack of a TP-induced LTR may indicate non-effective—or less than ideal—needling placement or protocol.

Study	Comparison	RCT (Y/N)	N (M/F)	N (M/F): group A	N (M/F): group B	N (M/F): group C	N (M/F): group D	Mean Age	Tissue	Diagnosis	LTR	Outcome Measure	Result	Additional
[5]	SA vs. non-TPN A vs. TPN acp vs. SH A	Y	40 (29:11)					47-80	Neck muscles	Chronic neck pain > 6 months	Noted for TPN, only one LTR at each TP	Pain (VAS), QOL, NDI	TPN: less pain, > QOL	Non-radiating pain
[6]	Phonophoresis Hydrocortisone (PhH) vs. UT	N	60 (0:60)	Control: 15	UT: 15	PR (pressure release): 15	PhH: 15	21-24	UT	3 months to 1 year	No mention of LTR	Pain intensity, PPT, and AROM	Significant pain reduction all groups (P<0.001)—except for the control group. PhH and PR had more significant pain reduction compared to the UT group.	
[7]	DN vs. MT vs. both	Y	Initial: 150, 35 stopped Tx	DN: 39 (11/ 28)	MT (13/25): 38	CoB (13/24): 37		36-47	C1-C2	Cervicogenic Headaches	No mention of LTR	Algo-meter for PPT, SP-36 questionnaire	Group C (CoB) had the most notable change compared to the other groups.	
[8]	High-Power Pain Threshold Ultrasound Therapy (HPPTUS) vs. Local TP Injection	Y	Initial: 197, ended with 42	HPPTUS: 20 (3/17)	TrP: 22 (2/20)			41-56	UT	Myo-fascial TP in the UT (0-4 weeks)	No mention of LTR	VAS and cervical ROM (w/ goniometric measurement)	Saw improvement of VAS in both groups, but it was not statically significant	One patient in HPPTUS developed erythema and dropped out on day-3
[9]	ESWT 1 session vs. ESWT 3 session using Minilith SL1 shockwave generator	Y	Initial: 108, ended with 60	ESWT one session: 30(6/24)	ESWT for 3 sessions: 30(5/25)			35-48	UT	MPS w/ failure of conservative therapies	No mention of LTR	TPs, pain, PGA, MDGA, NPDS, NHP, and HAM-A	Significant improvement was seen in both groups; there was no significant difference in results between the two groups.	
[10]	Ultrasound-Guided TPDN vs. Non-ultrasound-Guided TP Dry Needling	Y	Initial: 133, ended with 133. shoulder dysfunction specifically: n= 64	W/ US guided at shoulder: 45	W/o US guided at shoulder: 19			Median in Group A: 56. Median in Group B: 58	Shoulder	MPS	Positive for LTR	VAS	Both groups showed a significant decrease in VAS: Group A: 84% of patients, Group B: 64.5%	Group A required fewer needles and had a higher percentage of eliciting the LTR compared to Group B

Table 1. *TP needling efficacy versus other modalities; 1 of 3.*

Study	Comparison	RCT (Yes/No)	N (M/F)	N (M/F): group A	N (M/F): group B	N (M/F): group C	Mean Age	Tissue	Diagnosis	LTR	Outcome Measure	Results	Additional
[11]	Strain-counter-strain (SCS) vs. DN	Y	Initial: 39, ended w/ 34	DN: 12 (4/8)	SCS: 10 (3/7)	Sham SCS: 12 (2/10)	32	UT	MPS	Positive for LTR	VAS, PPT, NDI Questionnaire	No statistical significance between all groups. The study showed a reduction in VAS in all 3 groups	NDI scores were significantly decreased in the SCS group, but not the other 2 groups
[12]	Manual Pressure Release (MPR) vs. Muscle Energy Technique (MET)	Y	Initial: 51 (0/51), ended with 45	MRP: 15	MET: 15	Control: 15	21-26	UT	Nonspecific neck pain	No mention of LTR	VAS, ROR, NDI, PPT	MPR and MET were shown to reduce pain and muscle tenderness, improve neck disability, and increase ROM; marginal improvement of PPT score in the control group	All groups received postural advice and active exercises
[13]	Manual Passive Muscle Shortening (MPMS) vs. Positional Release Therapy (PRT)	Y	Initial: 30 (0/30), ended w/ 30	MPMS: 15	MRP' Control: 15		21-22	UT	Latent MTrPs	No mention of LTR	VAS, PPT, cervical AROM of lateral flexion	MPMS and PRT showed a significant increase in PPT, decrease in VAS, and increase in right lateral cervical flexion	
[14]	US vs. Ischemic Compression (IC)	Y	Initial 66 (29/36); ended with 66	IC: 22 (9/13)	US: 22 (10/12)	Sham US: 22 (10/12)	34-46	UT	Latent MTrPs	No mention of LTR	AROM, BEA, PT	Both treatments showed an immediate effect on MTrPs; no significant changes in the sham US group.	
[15]	DN vs. Friction Massage (FM)	Y	Initial: 44, ended with 40 (5/35)	DN: 20 (4/16)	FM: 20 (1/19)		33-49	sub-occipital, temporalis, SCM, and UT	Tension-type headaches >6 months + 3 trigger points	No mention of LTR	Frequency, intensity, pain, cervical ROM	Both groups had a significant improvement in reducing the frequency and intensity of headaches and pain threshold at theTPs.	DN showed an improve-ment in extension for cervical ROM. Other cervical ROM showed no improve-ment
[16]	EMLA cream phono-phoresis (PH) vs. US	Y	Initial: 50 (8/42), ended with 50	PH: 25 (5/20)	US: 25 (3/22)		36-45	UT	MPS	No Mention of LTR	NTP, pain intensity at rest, pain intensity w/ movement, lateral cervical ROMs, NPDS	Both groups had a statistically significant decrease in the number of TPs, but the PH group had a considerable statistical improvement in reduction of pain at rest, NPDI score, and had an overall more signifi-cant decrease in NTP	

Table 2: *TP needling efficacy versus other modalities; 2 of 3.*

Study	Comparison	RCT (Y/N)	N (M/F)	N (M/F): group A	N (M/F): group B	N (M/F): group C	Mean Age	Tissue	Diagnosis	LTR	Outcome Measure	Result	Additional
[17]	DN vs. High-Power Pain Threshold US (HPPT)	Y	Initial: 91, ended with 61 (8/52)	HPPT: 30 (3/27)	DN: 31 (5/26)		38-50	UT	MPS > 3 weeks	No mention of LTR	Primary: VAS, NPDS. Secondary: number of painful TPs, ROM of the tragus-acromioclavicular joint, SF-36, Beck Depression Inventory, and Sonoelastographic	HPPT and DN were shown to be effective at treating MPS. HPPT was shown to be more effective at reducing muscle stiffness and decreasing anxiety. There was no difference between the therapies in reducing pain or increasing ROM.	
[18]	US vs. ESWT	Y	Initial: 120, ended with 59 (14/45)	US: 29 (9/20)	ESWT: 30 (5/25)		35-48	UT	MPS	No Mention of LTR	Number of TrP, PGA, MDGA, NPAD, NHP, HAM-A	Both groups had a statistically significant improvement of number or TrPs, the severity of pain, PGA, MDGA, NPAS, NHP, and HAM-A scales. ESWT had a greater significance in NPADS and NHP scales at the end of 12 weeks.	
[19] (not complete sufficient areas)	Lidocaine injection vs. botulinum toxin (BTX-A); injection vs. DN	Y	Initial: 29 (6/23) ended w/ 29	Lidocaine: 10	DN: 10	BTX-A: 9		Cervical, back, shouler (UT, MT, LT), levator scapula)					
[20]	Local anesthetic (2mL of 1% lidocaine) Injection vs DN	Y	Initial: 80, (28/52)	Lidocaine: 40 (14,26)	DN: 40 (14,26)		37-47	UT	MPS > 1 month	Positive for LTR	VAS, BDI, Active cervical ROM	Statistically significant improvement in both groups in VAS, cervical ROM, and BDI after 4 and 12 weeks. No significant difference between the groups when compared	
[21]	Low vs. moderate vs. high-dose US therapy	Y	Initial: 75, ended with 61 (21/40)	Moderate: 21 (8/13)	: high 20 (7/12)	Low: 20 (6/14)	35-41	UT	MPS > 3 weeks	No mention of LTR	VAS, NTP, PPT, RT-AJ, NPDS	Post-treatment, Group B showed significant improvement in VAS, RT-AJ, NPDS compared to Group A and C.	
[22]	ART w/ US vs. SCS w/ US	Y	Initial: 60	ART + US: 20	SCS+ US: 20	US: 20		UT	Latent MTrPs	No Mention of LTR	Cervical ROM, PPT, trapezius muscle length	Group A and Group B demonstrated effective treatment for latent TPs in UT, compared to US only. There was no significant difference between Group A and Group B.	

Table 3: *TP needling efficacy versus other modalities; 3 of 3.*

Conclusion

Although DN provoked LTRs in only 16% of the reviewed studies, the LTR-provoked group experienced significant pain reduction and increased ROM. Thus, preliminarily, it can be posited that a DN-induced LTR will indicate—to the physician, therapist, and patient—that pain will likely and gradually diminish, and movements may become less restricted, positively affecting the patient quality of life (QoL).

LTR is vital in recognizing TPs and helpful in treating patients, resulting in maximum benefit. However, this procedure can cause post-treatment, application-area tenderness.

Future research should investigate the number of LTRs resulting in a maximal benefit of dry needling at a specific trigger point. As a valuable and pertinent footnote to this systematized review, eliciting an LTR with 0.12 mm needles typically reduces post-treatment muscle soreness and pre-treatment patient anxiety from needling. Also, this needle gauge enhances needling therapy efficacy as noted in comparison studies.

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, DC, 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).

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