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Therapy Localization in Applied Kinesiology: Validation by Means of Blinding in a Cohort Study

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Abstract

Objective. In manual muscle testing (MMT) by an applied kinesiologist, when the patient is applying therapy localization (TL), (1) is the TL specific for the region touched; and (2) are test results consistent regardless of the area touched?
Methods: A Diplomate in applied kinesiology performed MMT of the middle deltoid of 36 volunteers. Following an initial MMT in full view of the patient, the subject was shielded from the examiner with the exception of the left arm. A research assistant likewise out of view of the examiner provided randomized cues to the patient to touch a site (1) C6, proposed to be active in TL of the middle deltoid, (2) C2, an inactive region, or (3) the right knee. After each patient touch, the MMT was conducted with blinded results recorded by the examiner. Chi-Square analyses were conducted to assess whether any of the three-blinded TL procedures produced a change of muscle activity, as well as the consistency of each response.
Results: The only significant change of response was recorded when the subject touched C6.Test responses revealed a no-change consistency of 71% for the knee session, 86.2% for the C2 session, and 76.5% for the C6 session. Chi Square analyses indicated that the difference between consistency (no change) and inconsistency (change) was significant compared to chance alone.
*Conclusions***:** With examiner blinded, TLs appear to be specific for C6, the active myotome for the middle deltoid muscle. Good consistency of testing (intra-examiner reliability) was also observed.

***Keywords*:** Kinesiology, applied, musculoskeletal manipulation, reliability and validity

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Introduction

A key component of applied kinesiology emerged when Goodheart observed that the results of manual muscle tests (MMT) changed when a patient touched an area of dysfunction, which became known as *Therapy Localization (TL).* Specifically, a muscle that was classified as "weak" from test results was proposed to become "strong" under those circumstances[1], pointing to dysfunctions involving any of the following: reflexes, subluxations, soft tissue injuries, meridian points, and nerve receptors [1]. Similarly, an area touched by the patient that led to the weakening of a muscle that previously tested "strong" suggested a subclinical involvement; i.e., a reflex that is active but not engaged enough to cause a muscle to test "weak" without the TL [2].

In terms of neurophysiology, the essence of TL theory is that input from low-threshold mechano-receptors in the skin can modulate ongoing activity in muscles. Generally speaking, stimuli that are applied to different somatic sites could interact in such a manner that one stimulus controls the neural activity recorded at another site [3]. According to Goodheart's hypothesis, the activity of TL correlates with a spinal gating mechanism that is reminiscent of the gate control theory of pain perception [4, 5]. In particular, TL is postulated to stimulate mechanoreceptors, thereby influencing pain perception and muscle function. The TL model is consistent with Hilton's Law, which states that, "a nerve trunk which supplies the muscles of any given joint also supplies the muscles which move the joint and the skin over the insertion of such muscles [6, 7]." Such is to imply that dermatomes are neurologically integrated with myotomes and sclerotomes, producing associated sensory and motor dysfunction. If there were an organic or biomechanical encroachment or compression involving the ventral nerve root, for instance, one would anticipate autonomic impairment in the associated viscertomes and dermatomes. This is found in routine AK examinations [2].

Although there is paucity of experimental literature describing TL and none pertaining to its mechanism per se, a variety of analogous approaches involving objective measurements — including cutaneomotor reflexes-- in the basic sciences could be proposed to explicate the primary characteristics of TL.

In laboratory rats, for instance, colorectal distention (albeit a noxious rather than innocuous stimulation) produced a visceromotor reflex, as quantified by taking electromyographic (EMG) recordings from the external oblique muscle of the upper abdomen. Interestingly, a jejeunal distention blocked the reflex [8], consistent with how TL in a different area would be proposed to elicit opposing responses (muscle weakening or strengthening). Elsewhere, it was observed that afferent inputs from the skin and viscera affected both the activity of the bladder and skeletal muscle surrounding the urethra [9].

In acute spinalectomized cats, there is further evidence supporting the crosstalk and efferent activity in different regions of the body, a central component of TL. Specifically: (1) microelectrode recordings in the thoracic cord revealed that cells located in the lamina 5 responded to both the fine myelinated afferents from the splanchnic nerve as well as to afferents from the skin, suggesting the convergence of signals [10] and (2) thermal and mechanical stimulation of the skin at various segmental levels elicited reflex changes in the heart rate [11]. In intact cats as well as baboons and monkeys, it has long been known that information from cutaneous receptors can modulate motorneuronal activity [12=14].

Further evidence reminiscent of the hypothesized TL is provided in human studies:

1. Strong synaptic coupling exists between the tactile afferents in the sole of the foot and motoneurons supplying muscles that act about the ankle. This was observed with microelectrodes which were inserted percutaneously into the tibial nerve of human subjects, in which reflex modulations of whole muscle electromyography (EMG) were observed for each of 4 classes of low-threshold cutaneous mechanoreceptors. Simply stated, this study demonstrated that stimulation of the skin may be responsible for changes in muscle strength, which is the basic tenet of TL. Indeed, the cutaneomuscular reflexes observed may be

themselves a part of the mechanism of TL [15].

2. A neuroreflexology-based screening test (Medex device) was shown to have a significant degree of correlation with conventional medical evaluation in assessing internal organ pathologies. With 150 patients participating in the study, substantial sensitivity (>70%) was measured for cardio-vascular, respiratory, gastrointestinal and genitourinary diseases. Correlation was significant ($p < 0.01$) for all categories except for blood and lymphatic disease. In other words, electrodermal reflexes of the skin may be indicative of internal organ pathologies—a phenomenon which constitutes a major portion of the hypothesized TL [16].
3. EMG recordings in 15 patients demonstrated that stimulation of the median nerve reduced the size and number of descending cortico-spinal volleys that were evoked by transcranial magnetic stimulation in relaxed or active muscle. This suggested that mixed or cutaneous input from the hand can suppress the excitability of the motor cortex at short latency, which may contribute to the initial inhibition of the cutaneomuscular reflex. This could mimic the changes in muscular strength in MMT produced by TL [17].
4. In patients with chronic cervical radiculopathy, light pressure in the symptom-matic arm is painful and accompanied by a widespread increase in EMG activity. Palpation of adjacent soft tissues is painless and unaccompanied by EMG activity. The light pressure applied is similar to what happens in TL when the patient gently touches an area of suspected injury or dysfunction, producing a change in muscle function that can be useful in diagnosis [18].
5. In two separate populations (23 normal [random] and 17 athletic [strong]), a modified shoulder abduction manual muscle test demonstrated strength changes following the tactile stimulation of the skin, even after isometric strength had decreased after the maximal contraction. Specifically, scratching applied inferior to the clavicle on the clavicular head of the pectoralis major muscle revealed further decreases in isometric strength as quantified by a dynamometer system (Cybex II). The neurophysiologic inhibition of strength following the tactile stimulation of the skin again appears to mimic the effects of TL [19].
6. Cutaneomotor reflexes, a mechanism resembling if not the actual TL response, have been abundantly described in the literature. For example, modulation of ongoing EMG activity in the small hand muscles was induced by stimulation of the skin of the fingers [20]. In a related study, the authors pointed out that "cutaneous stimulation has previously been shown to modulate the amplitude of the motor evoked potential and to shorten the duration of the silent period evoked by transcranial magnetic stimulation [in relaxed target muscles [21]."

Yet in all these studies, a clear and reproducible physiological confirmation of the clinical effect of TL in human examinations is lacking. Further evidence supporting MMT as practiced in applied kinesiology is likewise needed. A plausible approach to providing such information is to exploit a set of circumstances in human examination which confirms the validity of "strong" and "weak" results in manual muscle testing, if not TL itself. This was partially accomplished by Caruso and Leisman [22, 23], who provided evidence with instrumentation that the classifications of muscles as weak and strong as determined by examinations by the applied kinesiologist could be regarded as both objective and reproducible with sufficient experience and training. These investigators examined patterns of force, timing, and movement for over 700 muscle tests with specially designed equipment (pressure transducers and electro-goniometers). They used simple mathematical applications to find potential patterns of force and displacement that would correspond to patterns of "weak" muscle tests obtained from healthy volunteers. The result was the creation of a model that was not only able to clearly discriminate between "strong" and "weak" muscles, but also was

accurate 98% of the time for applied kinesiology practitioners with 5 or more years of training and experience [23].

Other instrumental evaluations of the muscle testing procedure in AK utilized recorded somatosensory evoked potentials (SEP) on limbs contralateral to the stimulated side. In all subjects, the baseline in which no muscle test was performed and the control ("strong") muscle test recordings were comparable, while the pattern from the "weak" muscle test displayed increased amplitudes. The suggestion was that a neurologic basis existed for manual muscle testing [24].

For TL itself, however, a potential confounder has thus far not been described in the literature. That pertains to the visual cues that exist between patient and practitioner, such that any nonverbal signals have the potential to perturb the muscle response and/or practitioner's assessment in the testing procedure. Verbal and some nonverbal cues between patient and practitioner were removed in an inter-examiner reliability determination of muscle testing, but this did not involve TL or sufficient shielding of the examiner from the patient to eliminate all nonverbal cues [25]. To address this problem more directly, our approach was to subject TL to the following hypotheses:

1. Under conditions in which the examiner is unaware of whether the patient is applying TL, is the phenomenon specific to the region in which a touch is proposed to initiate a change in muscle activity?

2. Regardless of the area touched by the patient, is the scoring by the examiner consistent?

Materials and Methods

Personnel and Sample Size

The Institutional Review Board of the National Institute for Brain and Rehabilitation Science in Nazareth, Israel, approved this project, all subjects having provided written consent to participate after being presented with the experimental protocol and provided a modest financial incentive ($50) to complete the study. A clinician from the New York metropolitan area with at least 7 years of muscle testing experience conducted the investigation in the practitioner's private offices. Participants were drawn both from patient pools of the practitioners and from volunteers recruited locally. With effect sizes (Cohen's d) estimated at 0.35 [26] at 80% power at the significance level of $p = 0.05$, the calculated sample size for a 1-tailed t test was 204. Given 1 clinician and 6 measurements per subject yielding 6 samples per subject, we estimated that a minimum of 34 (204/6) subjects was required to detect differences. We recruited 36 volunteers (21 male, 15 female ages (19-65) with 20 experiencing neck or shoulder pain for a minimum of 2 days prior to muscle testing. Inclusion criteria included being able to speak and understand English adequately, while exclusion criteria included previous spinal surgery, clinically significant chronic inflammatory spinal arthritis, severe osteoporosis, spinal pathology or fracture, history of bleeding disorder, known arterial aneurysm, current pregnancy, and impediments to being able to participate in the informed consent process.

Muscle Selection

The *middle deltoid* muscle on the left arm was chosen for testing for two reasons. (1) Good inter-examiner reliability of the deltoid muscle has been demonstrated [27] and (2) with the patient in a seated position with head and neck kept within a neutral position, TL may be performed with a minimum of contortion and substitution that could independently affect the results of the muscle test.

Muscle Testing Protocol

The MMT itself was conducted as a submaximal break test, with resistance applied by the patient to increasing test pressure by the examiner over a 1-3 second period. The test was stopped when a "lock" (full resistance) was perceived by the tester [28-30] with the result (strong or weak) recorded by the examiner out of sight of the patient. The MMT was next repeated by having the patient perform TL by touching any one of three regions as described below,

including the C6 region, proposed to specifically produce TL to the deltoid muscle [30]. This was accomplished tangentially, with the tips of the index, middle, and ring fingers. Head and neck position of the patient were maintained in the neutral position, and blinding of the subject to the test result was maintained.

Out of sight of the examiner (see Figures 1 and 2), a research assistant asked the patient to extend the middle and index finger of the right arm and then guided the patient's right arm to one of three positions: (1) resting on the right thigh, (2) touching the C2 vertebral region with just the two aforementioned fingers, or (3) touching the C6 vertebral region with the same two fingers. The sequence of these three patient positions through five separate muscle tests was dictated by means of a random number generator program [31] unknown to the examiner. Once the patient's hand reached the prescribed position, the examiner repeated the MMT as described previously. The results of all examinations (un-blinded initial examination and the five blinded tests) were recorded by the examiner out of sight of the patient and research assistant.

Figure 1. Shielding of practitioner from patient during TL MMT procedure.

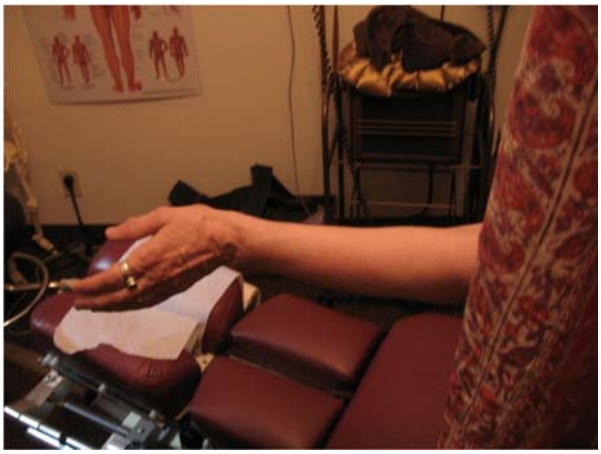

Figure 2. Portion of patient visible to practitioner during TL MMT procedure

Data Analysis

A Chi^2 analysis was performed to assess the level of difference for each of the following actions taken:

A represented the unblinded initial examination.

0 represented blinded TL with patient touching the right thigh.

C2 represented blinded TL with patient touching the C2 vertebral region.

C6 represented blinded TL with patient touching the C6 vertebral region.

A vs 0

A vs C6

A vs C2

0 vs C6

0 vs C2

C6 vs C2

To calculate the consistency of a test response for any of the three patient actions during the blinded TL tests, the number of patient response changes (strong to weak or vice versa) and number of opportunities to change a response were recorded for each of the sessions 0, C6 and C2. The number of opportunities equaled the number of chances the subject had to change the response that had been determined by the examiner.

Results

As shown in Table 1, the only significant change of response was recorded when the subject touched C6; not when the subject touched C2 or touched his or her thigh. This suggested that, under conditions of blinding the examiner, a positive TL response occurred specifically when the patient touched the active myotome (C6) for the middle deltoid muscle rather than C2 or the knee.

Table 1. Specificity of Blinded TL under Three Separate Protocols of TL (0, C2 and C6)

A compared to 0:

a. Null Hypothesis- there is no significant difference between the Sessions, A and 0, for all Strong-Weak observations.

	STRONG	WEAK	
	Observed – Expected	Observed - Expected	**TOTAL**
A	31 – 27.4	5 -8.6	**36**
0	39 – 42.6	17 – 13.4	**56**
TOTAL	**70**	**22**	**92**

0.47 + 0.3 + 1.51 + 0.98 = 3.26

df = 1
Chi Sqr Critical = 3.841
Chi Sqr = 3.26A compared to 0:
3.26 < 3.84 Null is Accepted at the 0.05 level. There is No significant difference between the Sessions A and 0 for all Strong-Weak observations. 3.26, $p < 0.05$, df = 1.

A compared to C6:

b. Null Hypothesis- there is no significant difference between the Sessions, A and C6, for all Strong-Weak observations.

	STRONG	WEAK	
	Observed – Expected	Observed - Expected	TOTAL
A	31 -26.4	5 – 9.62	**36**
C6	43 – 47.6	22 – 17.4	**65**
TOTAL	**74**	**27**	**101**

0.8 + 0.44 + 2.22 + 1.22 = 4.68

4.68 > 3.84 Null is rejected at the 0.05 level. There is a significant difference between the Sessions A and C6 for all Strong-Weak observations. 4.68, $p < 0.05$, df = 1.

A compared to C2:

c. Null Hypothesis- there is no significant difference between the Sessions, A and C2, for all Strong-Weak observations.

	STRONG	WEAK	
	Observed – Expected	Observed - Expected	TOTAL
A	31 -27.6	5 – 8.3	**36**
C2	42 – 45.3	17 – 13.7	**59**
TOTAL	**73**	**22**	**95**

0.37 + 0.26 + 2.18 + 0.64 = 3.45

0.42 + 0.24 + 1.31 + 0.79 = 2.76

2.76 < 3.84 Null is accepted at the 0.05 level. There is no significant difference between the Sessions A and C2 for all Strong-Weak observations. 2.76, $p < 0.05$, $df = 1$.

0 compared to C6:

d. Null Hypothesis- there is no significant difference between the Sessions, 0 and C6, for all Strong-Weak observations.

	STRONG	WEAK	
	Observed – Expected	Observed - Expected	TOTAL
0	39 – 37.9	17 – 18	**56**
C6	43 – 44.0	22 - 21	**65**
TOTAL	**82**	**39**	**121**

0.03 + 0.02 + 0.06 + 0.05 = 0.16

0.16 < 3.84 Null is accepted at the 0.05 level. There is no significant difference between the Sessions 0 and C6 for all Strong-Weak observations. 0.16, $p < 0.05$, $df = 1$.

0 compared to C2:

e. Null Hypothesis- there is no significant difference between the Sessions, 0 and C2, for all Strong-Weak observations.

	STRONG	WEAK	
	Observed – Expected	Observed - Expected	TOTAL
0	39 – 39.4	17 – 16.6	**56**
C2	42 – 41.6	17 – 17.4	**59**
TOTAL	**81**	**34**	**115**

0.01 + 0.0 + 0.02 + 0.01 = 0.04

0.04 < 3.84 Null is accepted at the 0.05 level. There is No significant difference between the Sessions 0 and C2 for all Strong-Weak observations. 0.04, $p < 0.05$, $df = 1$.

C6 compared to C2;

f. Null Hypothesis- there is no significant difference between the Sessions, C6 and C2, for all Strong-Weak observations.

	Strong	Weak	
	Observed – Expected	Observed - Expected	TOTAL
C6	43 – 44.6	22 -20.4	**65**
C2	42 – 40.4	17 – 18.6	**59**
TOTAL	**85**	**39**	**124**

0.06 + 0.06 + 0.13 + 0.14 = 0.39

0.39 < 3.84 Null is accepted at the 0.05 level. There is no significant difference between the Sessions C6 and C2 for all Strong-Weak observations. 0.39, $p < 0.05$, df = 1.

Chi Square Summary Table:

For all: $p < 0.05$, df = 1, Chi Square critical value = 3.84

Chi Sq	0	C6	C2
A	Null is Accepted, No significant difference, 3.26	Null is Rejected, Significant difference, 4.68	Null is Accepted, No significant difference, 2.76
0		Null is Accepted, No significant difference, 0.16	Null is Accepted, No significant difference, 0.04
C6			Null is Accepted, No significant difference, 0.39

Table 2 indicates the number of changes of response that were recorded *within* each of the three sessions (0, C2 or C6), representing the degree of inconsistency of examiner testing. When matched against the degree of no change (consistency). Test responses indicated a no-change consistency of 71% for the 0 session, 86.2% for the C2 session, and 76.5% for the C6 session. Chi Square analyses indicated that the difference between consistency (no change) and inconsistency (change) was significant compared to chance alone.

Table 2. Assessment of Examiner Consistency within Each of Three Blinded TL Protocols (0, C2 and C6)

1. For the C2 Session there were 4 changes out of 29 opportunities to change a response.
C2; 4 out of 29
C2 % no-change consistency = (29-4) / 29 x 100 = 86.2% no-change response consistency

For C2 session- 25 no-change responses vs 4 changed responses:

	Observed	Expected	(Fo-Fe-0.5)	$(Fo-Fe-0.5)^2$	$\frac{(Fo-Fe-0.5)^2}{Fe}$
No-Change	25	14.5	10	100	6.9
Changed	4	14.5	-11	121	8.3
	29	29			15.2

df = 1
Chi Square Table = 7.879, $p < 0.005$
Chi Square calculated = 15.2
15.2 > 7.879, Null is rejected. There is a significant difference between no-change and changed responses, df = 1, 15.2, $p< 0.005$.

2. For the 0 Session there were 9 changes out of 31 opportunities to change a response.
0; 9 out of 31
0 % no-change consistency = (31-9) / 31 x 100 = 71% no-change response consistency
For 0 session- 22 no-change responses vs 9 changed responses:

	Observed	Expected	(Fo-Fe-0.5)	$(Fo-Fe-0.5)^2$	$\frac{(Fo-Fe-0.5)^2}{Fe}$
No-Change	22	15.5	6	36	2.3
Changed	9	15.5	-7	49	3.2
	31	31			5.5

df = 1

Chi Square Table = 5.024, $p < 0.025$

Chi Square calculated = 5.5

5.5 > 5.024, Null is rejected. There is a significant difference between no-change and changed responses, df = 1, 5.5, $p< 0.025$.

3. For the C6 Session there were 8 changes out of 34 opportunities to change a response.

C6; 8 out of 34

C6 % no-change consistency = (34-8) / 34 x 100 = 76.5% no-change response consistency

For C6 session- 26 no-change responses vs 8 changed responses:

	Observed	Expected	(Fo-Fe-0.5)	$(Fo-Fe-0.5)^2$	$\frac{(Fo-Fe-0.5)^2}{Fe}$
No-Change	26	17	8.5	74.8	4.4
Changed	8	17	-9.5	90.3	5.3
	34	34			9.7

df = 1

Chi Square Table = 7.879, $p < 0.005$

Chi Square calculated = 9.7

9.7 > 3.84, Null is rejected. There is a significant difference between no-change and changed responses, df = 1, 9.7, $p< 0.005$.

Discussion

This cohort study was an attempt to block the visual cues that could present a confounding factor in TL. It simply removed from sight all but the anatomical region of the patient harboring the muscle to be tested, such that patient and examiner no longer had mutual visual contact. The suspicion especially fell upon the examiner, who, if knowing that the patient was applying a TL, might have unconsciously altered the scoring of the muscle as "weak" or "strong" or even the conduct of the MMT itself. In addition, it was deemed appropriate to execute sham TL procedures to determine if the suspected myotome for the middle deltoid muscle at C6 [31] was both active and specific for producing the change of muscle response characteristic of the TL.

The analysis of the tests conducted upon 36 patients indicated that the TL response occurred only if the C6 region was touched, unbeknownst to the examiner. Furthermore, whatever response was recorded with either the active C6 TL, the presumed inactive region at C2, or the sham area on the right thigh, was consistent and not a result of chance. These two observations support the theory that the actual touching of a specific area by the patient may alter the response of a test muscle in the MMT conducted in applied kinesiology, devoid of any knowledge by the practitioner—and that there can be consistency (intraobserver reliability) in the scoring of a result of MMT regardless of the patient's actions.

One possibility that could have affected the outcomes of TL is that the subject was simply distracted while conducting the maneuver, creating a

change in the deltoid muscle response during testing. However, the fact that a positive TL could not be recorded when the participant touched either the C2 area or the right thigh renders this scenario unlikely.

In theory, the essence of TL is that input from low-threshold mechanoreceptors in the skin can modulate ongoing activity in muscles. Specifically, stimuli applied to different somatic sites may be capable of interacting in such a fashion that one stimulus controls the neural activity recorded at another site. In this investigation, we employed an MMT procedure that is taught and validated by the International College of Applied Kinesiology, presented only to doctors who are licensed to diagnose. It has thus been designated as Professional Applied Kinesiology (PAK). The methods of PAK are taught worldwide by Diplomates in AK who require over 300 hr of classroom study with multiple instructors and 3 years of clinical practice. The rigor of this protocol, requiring in every MMT (a) the same starting point, direction, and magnitude of force, (b) the application of force at a constant rate of speed, (c) the same point of contact on the patient, (d) the same point of contact on the examiner, (e) the same position of the examiner's elbow, arm and forearm, (f) the same plane of the examiner's shoulders, and (g) the same position of the examiner's body has been described in further detail elsewhere [32, 33]. Its observance renders the MMT employed more likely to avoid many of the pitfalls and criticisms of AK described elsewhere [32].

In addition to possessing the PAK background, our practitioner had at least 7 years of clinical practice. It has been demonstrated elsewhere that practitioners with at least 5 years of clinical experience demonstrated 98% agreement in their ability to distinguish strong and weak responses of the pectoralis major in over 750 trials [23].

The distinctions sought in weak and strong muscle responses in PAK are of a different nature than all those reported previously. Here it is a matter of timing in subjecting the muscle to a test, within a response time on the order of 1 sec. This does not determine frank muscle strength or endurance, the measurements of which can take up to 30 sec [29].

The importance of physician professional behavior, and of nonverbal communication between physician and patient in particular, has been supported in numerous studies. Correlations between patient satisfaction and two major nonverbal categories (immediacy and relaxation) were reported over 30 years ago.[34] Furthermore, it was found possible to predict patient satisfaction from the physicians' nonverbal communication skills [35, 36]. It is conceivable that nonverbal communication could be linked to the quality of care and positive outcomes, since numerous studies have associated patient satisfaction with the latter two entities [37-39]. The behavior of the physician in general can be linked to patient outcomes [40]. Reducing as many of these factors as possible to support the validity of TL thus becomes a matter of considerable interest, a task undertaken in this study with outcomes meriting further study.

Limitations and Suggestions for Further Research

The principal limitation of this investigation was that this study was confined to the middle deltoid as a single test muscle. Future research will need to generalize these findings with the application of additional muscles and myotomes in therapy localization. Other future research needs to address the magnitude of presumed TL effects when applied with probes other than the bare tips of the fingers used in this investigation, such as with whole hands, using a glove, having the practitioner rather than the subject apply TL, applying pressure at varying angles, or using an applicator other than the hand altogether.

An additional shortcoming was the fact that only a single examiner was employed, such that the inter-examiner reliability could not be confirmed in this investigation. However, it has been reported previously that excellent agreement between three PAK Diplomate examiners—including one involved in the current study--in confirming the presence and absence of TL in the middle deltoid in the testing of over 30 patients can be obtained [41] Nevertheless, multiple examiners in a blinding experiment similar to the one reported here should be employed in future research.

Finally, cohorts of patients larger than the 36 employed here, perhaps with demographic, gender, age, and symptomatic subgroups would be worth

subjecting to a protocol similar to the one reported in this investigation.

In spite of these reservations, this remains the first investigation which appears to have supported two facets (blinding, repeatability) of the reliability of TL, using a single muscle involving both patients of a PAK practitioner and subjects recruited locally.

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