Manual Therapy and Neural Mobilization: Our Approach and Personal Observations

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NEW DIRECTIONS

In the infancy of the 21st century, the profession of physical therapy is transforming towards a more autonomous practice involving advanced education, new techniques, new diagnostic criteria, and a plethora of research. The research involves all arenas of physical therapy from young to old and acute to chronic and in between. One common thread, however, is a trend and mass organizational effort towards evidence-based research.

The overall tenet of physical therapy is becoming clear with the publication and availability of *The Guide to Physical Therapist Practice.*[1] One of its many purposes is to delineate preferred practice patterns that will help physical therapists improve quality of care, enhance positive outcomes, enhance patient satisfaction, and increase efficiency and decrease unwarranted treatment approaches. An appropriate bridge from this theory to practice involves the evidence-based research paradigm. Physical therapists are best served if they combine clinical expertise with the best available external clinical evidence as a way to answer clinical questions, create more effective and efficient diagnoses, and improve upon treatment approaches.[2]

This symbiotic relationship between clinical application and external evidence is becoming more visible in clinics across the country. The clinic in which we work is no exception to this developing rule. In the early to mid 1990s, Paul Mettler, PT, owner and founder of our clinic, began to experiment with a new manual therapy technique.[3,4] Experimentation has led to refinement and some impressive clinical outcomes as documented through videotape, thermography, and SF-36 satisfaction surveys. Paul and all of us at our clinic feel it is essential and vital that more formalized outcomes are undertaken via an evidence- based approach. Through this approach, our goal is to be able to use available external evidence and clinical expertise and experiences related to this manual therapy technique to help answer some of our clinical questions and validate our outcomes scientifically.

The setting in which we practice involves many clients that have repetitive strain injuries or closely related chronic pain. More specifically, we treat many clients that have general diagnoses given by a referring physician regarding the upper extremity (ie, shoulder pain, thoracic outlet, carpal tunnel, elbow pain, forearm pain, and hand pain). Each client is evaluated as if they have no formal diagnosis in order to eliminate bias at the evaluation and allow for a more critical differential diagnosis. Often, our analysis is in line with the physician, and many times we may discover another appropriate diagnosis as an adjunct. Through our evaluation and testing procedures involving many different methods, we assign a physical therapy diagnosis to better direct our plan of care. Under this practice scrutiny, we are able to better use various treatment arsenals as a means to expedite treatment time, improve function, and improve patient satisfaction. Ultimately, we have found that regardless of the physician diagnosis, our unique ability for manual therapy guides us to the root of the problem and very high satisfaction among our clients. The question we ask ourselves with each patient is "are we making a difference?" and "how are we making that difference?" We feel we have a technique that takes us to that next level in 2 important ways. One, it has proven itself clinically; and two, we need to begin the process of strengthening this technique through the research method so we can disseminate this knowledge throughout the profession. The treatment technique that we have found to be invaluable for the upper extremity is the Mettler Release Technique® (MRT).

The research for upper extremity neurodynamic testing and treatment is growing. The research as it relates to the MRT and soft tissue restrictions is nonexistent. There are some studies that look at the pathophysiology and anatomy of the nervous system and significance as it relates to the upper extremity and rehabilitation.[5,6] The importance of understanding the neural tissue and how it functions is vital to our knowledge base. It is also important that we address the whole system in the upper extremity to include the skin and connective tissue. A literature search using Google and specifying terms such as "connective tissue mobilization" or "skin rehabilitation" leads the reader to 2 different treatment avenues. Under the "connective tissue mobilization" search, there are many sites that refer to soft tissue techniques related to massage and others related to instrumentation and tissue release. Under the "skin mobilization" search, many of the sites refer to burn care and dermatology care. Combining these 2 terms brings the reader to a more scientific search with many sites discussing connective tissue disorders and physiology related to such disorders. Consequently, much of the research today as it relates to myofascial tissue and skin has stemmed from studies looking at immobilization or direct trauma to the connective tissue at a macro and micro level. This research has led to 3 important ways that fascia can become dysfunctional and lead to painful musculoskeletal symptoms—trauma, chronic strain, and immobility.[7] The breadth of this research is small compared to muscle or nerves, but it serves as a guide for us to reach out for other contributors of pain. The MRT technique provides us an opportunity to delve deeper into the fascial and skin enigma as it relates to pain dysfunction in the upper extremity; and perhaps more importantly, a new treatment avenue.

Based on the lack of clinical and more scientific research related to fascia and the skin, we decided to come up with a simple study to answer some basic hypotheses. One, how does MRT compare to a more universally accepted treatment technique such as upper extremity neural mobilization and two, what affect does it have used in conjunction with that same technique. We chose a modification of an upper limb tension test for the median nerve as a means to objectively measure shoulder abduction range of motion. The following case study is an attempt to begin the process of 'digging' for answers and prompting more questions and research avenues. A brief overview of each technique follows with treatment approach and discussion to tie it together and hopefully create a positive thought process.

METTLER RELEASE TECHNIQUE®

Our clinic offers a strong foundation in physical therapy interventions with the addition of a manual therapy technique in MRT. This manual therapy intervention has influenced the way our clinicians diagnose, treat and educate our clientele with multiple diagnoses. The MRT technique has provided a treatment approach with broad applications pertaining to most any region of the body secondary to its clinical effectiveness and theorized mechanism. The technique requires special emphasis addressing the multidimensional structure of the skin and underlying connective tissue to promote improved structure and function. The skin is the largest organ in the human body providing a multitude of functions ranging from protection to insulation. Underneath the 3 dermal layers lies an intricate network of connective tissue varying in physical nature and cellular components. The myofascia is a specialized connective tissue of interest at our clinic due to its connection to the muscle and more superficial structures like the skin. It is this relationship of the myofascia, muscles, nerves, skin, and other physiological processes that drives our use of MRT and makes our clinic successful.

The actual application of MRT is far from haphazard and arbitrary. The initial examination procedure involves finding the dermal-fascial restrictions in the direction in which adhesions or inappropriate collagen formation has formed. A thorough and well-established subjective evaluation will help guide the clinician to areas of investigation and possible structure involvement. This is where a good knowledge base of anatomy, physiology, mechanics, and foundational principals in physical therapy bolster the search for culpable musculoskeletal structures. Physical therapists are well versed in knowing muscle referral patterns and concomitant trigger point influence[8] as well as muscle origin, insertion, action, and innervation.[9] Once an area of interest has been identified, the use of bilateral hands, fingers, and/or thumbs are used to specifically address the mobility of the skin and underlying fascia for passive elastic properties. To enhance grip and eliminate influence of oils from our fingers, we use latex finger cots to provide the passive force necessary to eventually break up the adhesions and restore normal structural elasticity. As we assess joint mobility by assessing end-feel, we also can assess dermal-fascial mobility in the same manner grading them as a mild end-feel, hard end-feel, or block.[3]

Treatment is an extension of assessment and evaluation. Now that a directional restriction has been located, a bilateral, equal and opposite tension is applied to the dermal-fascial tissue band. The latex cots prevent slipping and sliding and allow us to gauge our intensity as well as focus our application more specifically to the tissue involved (Figure 1). We also incorporate a natural phenomenon in our body to facilitate release and improve pain perception during application. This natural entity is the craniosacral rhythm.[10] This rhythm is not used as a separate treatment application but as an important component to the MRT treatment. Very often the release of the tissue will be felt immediately; however, some of the deeper and more adhered restrictions may take 15 to 30 seconds or more to break loose.[3] The ultimate end result is a return of the viscoelastic properties of the skin and connective tissue. This translates into improved functional and objective measurements immediately post-treatment or after a short period of time. Examples of objective measures we commonly use to assess progress and related functional improvement include active range of motion, strength testing using the Microfet®, visual analog pain scales, the Cervical Range of Motion apparatus, gait analysis, and neural tension tests. Our clinic also uses body region specific questionnaires at initial and discharge to gauge functional outcomes for every client.

Figure 1. Performing The Mettler Release Technique® on the upper extremity.

THE NEURAL INFLUENCE

Adverse neural tension is an abnormal response to mechanical stimuli of neural tissue.[11] The genesis of this abnormal tissue response can be from a variety of factors to include injuries (compression, vibration, and postsurgical), intraneural, extraneural, and anatomic. A factor that receives a significant amount of attention involves that of repetitive strain injuries, specifically with the upper extremities. A condition that has received a considerable amount of visibility in the medical community and also with the common public is carpal tunnel syndrome (CTS). Clinically speaking, there are times that a patient will have completed a CTS release in hopes of relieving their painful symptoms. Many times, the pain and symptoms persist and the patient is left asking, why? One answer is that perhaps the problem was not coming from the anatomically released transverse carpal ligament, perhaps, it was coming from somewhere else more proximally. A term to describe one such explanation is the 'Double Crush Syndrome.' The problem may not be a distal inflammation or obstruction, but a more proximal problem originating anywhere from the cervical region, the shoulder, or upper extremity. This is only one of many plausible explanations; ultimately, one must consider the nervous system as a dynamic, continuous system of complex interactions that often has multiple areas of investigation and hypotheses. Upper extremity anatomy is fairly constant, but the relationship of peripheral nerve pathways, anatomical landmarks, and clinical application is tantamount to our comprehensive understanding and treatment approach with upper extremity pain and symptoms. The 3 major peripheral nerve pathways of interest are the radial, median and ulnar. Having a good overview of upper extremity anatomy will provide the practitioner tools to identify possible areas of entrapment and their clinical ramifications.[12]

A thorough understanding of anatomy is a requirement to accurate palpation procedures by the therapist. Palpation has served as an integral part of an assessment routine in discerning areas of provocation as it relates to nerve involvement. These are often performed in areas where the nerves tend to be more superficial and easily tested such as the cubital tunnel in the elbow and the carpal tunnel in the wrist. To help refine our treatment approach, we want to look at the whole picture and not just a portion. Our goal is to not just treat one area of provocation but to delve deeper into our clinical arsenal and assess the system. The system as it applies here refers to the nerves, the muscles innervated by those nerves, the myofascia, and the skin.

Neurodynamic Testing

This assessment and treatment approach allows us to physically test the dynamics and associated sensitivity of the nervous system. The basis of this testing is not entirely new with an investigation of cervical nerve root complexes gaining some increased attention back in the late seventies. Bob Elvey discovered that maximal tension placed on the cervical nerve roots, brachial plexus, and peripheral nerves involved a certain upper extremity positioning at multiple joint angles.[13]

This position has become known as a 'base test' with a median nerve bias and consists of scapular depression, shoulder abduction and external rotation, elbow extension, forearm supination and wrist/finger extension with ulnar deviation. This test has often been referred to as the equivalent to the lower extremity straight leg raise. As with many other treatment techniques and positioning approaches, other terms and insights have developed to expand on Mr. Elvey's finding. There are other such 'base tests' that are currently used in the clinic and in the research that emphasize the median nerve, ulnar nerve, and radial nerve.

Technique modification in terms of patient positioning may need to be done to evaluate each of the respective peripheral nerves. Each joint position and passive positioning by the therapist may and often needs to be adaptable to various situations (previous injuries, decreased range of motion, or other comorbidities). It is up to the therapist to interpret symptom provocation and patient response as a means to tailor the testing position and treatment approach. In the same respect, altering joint position may be used as a means to sensitize the system and lead to a possible differential diagnosis.

For our study we chose to use the upper limb tension test that emphasized the scapular component over the glenohumeral component. Our positioning and joint movement is consistent with that of Butler[11] and described later. We chose this test to eliminate multiple joint involvement and as a means to measure shoulder abduction as our variable of interest (Figure 2).

Figure 2. Modified base test as used in our study.

SUBJECTS AND PARTICIPANTS

Three subjects were chosen for this study. All 3 subjects were employed by the investigating facility as therapists and ranged in age from 25 to 34. Two of the subjects were female and one male chosen at random from a total of 7 possible participants. All 3 subjects were right handed dominant as indicated through questioning. Subjects were selected out of a sample of convenience with some basic inclusion and exclusion criteria. All subjects were informed of the intent of the study and the different treatment variables involved. Each subject provided verbal consent. No approval from an Institutional Review Board was obtained.

Inclusion criteria included full passive range of motion in bilateral upper extremities, functional strength within normal limits, normal sensation and proprioception, and ability to lie supine for an extended period of time. Exclusion criteria included pregnancy, physical therapy in the previous 3 months, and any systemic or neurological diagnosis or symptoms.

Two different physical therapists performed the 2 different treatment strategies. The therapist that performed the neural mobilization and home exercise program had 6 years experience. The therapist that performed the MRT treatment has 22 total years experience and 11 years experience with MRT, specifically. All range of motion measurement and upper extremity splinting was done by an occupational therapist with 15 years experience with much of her clinical emphasis on the upper extremity, wrist, and hand.

Treatment Setup

We chose to look at 3 different treatment approaches on the 3 different subjects. One subject received only MRT, one subject received only neural mobilization technique [referred to by Butler as upper limb tension test two (ULTT2)] and concomitant exercises, and one subject received both MRT and neural mobilization techniques and exercise. Each subject randomly and blindly drew from a hat as to which treatment technique they would receive. For each treatment technique the right arm was chosen as the investigating side and the left arm used as a control.

Each subject was placed supine on a hi-lo plinth with the arms and legs extended and uncrossed. The cervical spine was visually placed in a neutral position in the frontal and sagittal plane. Our main reference point was the right acromion and its relationship to the perpendicular straight edge of the plinth. To help standardize placement of each subject, the acromion was situated along the cephalad edge of the plinth with the use of a straight edge ruler taped to the plinth as the marker. The acromion also served as a standardization of scapular depression with neural mobilization and as a measurement control for the appropriate subjects. The neural mobilization physical therapist depressed the scapulae to the level of first resistance but not to pain in conjunction with the subjective response given by the individual's perception of resistance and/or tension. Once this point was reached, the treating therapist backed off slightly and the distance from the straight edge to the superior aspect of the acromion was measured to establish the standard distance of shoulder depression for future measurements.

Moving distally, the elbow was standardized in a maximal extended position with combined forearm supination, wrist/finger extension, ulnar deviation, and thumb abduction, and shoulder abduction via passive influence from the therapist. These joints were passively moved until the parameters of first resistance and/or tension by the therapist and subjective perception by the individual were noted. At this point, our occupational therapist splinted the wrist, hand, and fingers to establish a baseline measurement and to standardize future measurements. Each subject was fitted with a custom molded splint.

The left upper extremity was measured and positioned in the same manner as above with the exception of the wrist, hand, and finger splint. Both upper extremities for all 3 subjects had baseline range of motion measurements to include shoulder abduction, wrist extension and ulnar deviation, finger extension, and thumb abduction. All range of motion measurements were performed by an occupational therapist using anatomical landmarks common to clinical practice.[14] This therapist was blinded to treatment approach with each subject to eliminate measurement bias. Follow up measurements looked at bilateral shoulder abduction range of motion as the primary variable of interest and left upper extremity wrist extension/ulnar deviation, finger extension, and thumb abduction as secondary variables of interest. Although no splint was used for the left upper extremity, the similar end-feel and subjective procedure was used for measurement purposes. Range of motion measurements were recorded as described above after the third and sixth treatment session for all subjects.

Procedure

Neural mobilization and exercise implementation was performed by the same physical therapist for all measurements and treatment sessions. Likewise, MRT was performed by the same physical therapist for each treatment session.

Treatment sessions were performed twice per week for all 3 subjects. Treatment times were 30 minutes for MRT and 15 minutes for neural mobilization with the total duration of the treatment sessions lasting 3 weeks or 6 total visits.

Neural mobilization treatments were performed in supine and using a hi-lo plinth. The subject remains relaxed with the feet uncrossed and the uninvolved extremity at their side. The subject is slightly angled obliquely for easier access to the scapulae. The therapist position is next to the plinth facing the direction of the subject's feet. The treating therapist depressed the right scapulae of each subject with concomitant upper extremity joint positioning as per median nerve bias ULTT2 (see Figure 3). This involved elbow extension, the wrist and fingers extended and ulnarly deviated, thumb abduction and shoulder abduction. The wrist was used as the 'tension' factor during mobilization of the neural tissues secondary to the ability to use shorter amplitude of motion and for ease of oscillation. At the point where tension was felt by the therapist and perceived by the subject, grade III oscillations were performed rhythmically and slowly. A total of 20 oscillations were done at each treatment session with an increase in excursions and joint positioning attempted as the subject progressed. Concluding the first treatment session, the subject was verbally instructed on a home stretching program designed to emphasize the median nerve. The exercise given consisted of the subject in a sitting position using specific positioning of the right upper extremity in a similar fashion to the testing and treatment position. Instruction involved the subject gently elevating the ipsilateral pelvis, depressing the ipsilateral scapulae, and maintaining upper extremity positioning while performing 20 oscillations daily. Verbal instruction was validated with subject performance in the presence of the therapist to ensure proper form and enhance compliance with home program.

Figure 3. Patient and therapist presentation during treatment.

During the MRT treatment sessions, the subject was placed in the same position as when performing the neurodynamic testing and treatment. The right upper extremity was positioned at the subjects' side and treated. To assist in locations of treatment, neural tension was induced in the same manner as above with the subject stating where sensations of 'pulling, burning, aching or tension' were experienced. The areas were noted and marked temporarily as a guide to direct the therapist in finding and treating dermalfascial restrictions if present. A thorough soft tissue assessment was conducted along the areas of interest in multiple directions to localize the bands of restriction. After identifying the restrictions, the therapist applied the MRT approach until an increase in tissue elasticity was detected. This treating therapist gave no exercises or patient education during sessions.

Results

The key variable of interest for this study was shoulder abduction. The right shoulder range of motion served as our manipulated variable and the left shoulder range of motion as our control variable. Each treatment technique for all 3 subjects demonstrated an increase in right shoulder abduction at the third and sixth visits with little variation noted in the left shoulder.

After the third visit, the largest increase in shoulder motion was with subject 3 (combined MRT and neural mobilization) and the smallest increase with just MRT. After the sixth visit, the largest increase in range of motion from initial was MRT combined with neural mobilization (5º to 29º), and compared to measurements from the sixth to the third measurement, it was subject one (MRT® alone) (14º to 25º). The least amount of range of motion from initial to after the sixth treatment (10º to 19º) and from the third to the sixth treatment visit was subject one (neural mobilization alone) (17º to 19º). Initial ranges for the right upper extremity of each joint can be seen in Table 1.

We did not control for left upper extremity range of motion with splinting. After the sixth visit, we tested the range of motion of the left wrist and finger extension, wrist ulnar deviation, and thumb abduction. The ranges were within 10° for all 3 subjects with the exception of thumb abduction for subject 1 and 2.

DISCUSSION

Upper extremity symptoms and diagnoses related to repetitive strain, trauma, immobilization, or postsurgery are very common in our clinic and across the country. The 3 subjects used in this study did not demonstrate known symptoms or diagnosable conditions that limited working status or functional status. During the evaluation period and subsequent treatment times, it became apparent, however, that each subject has a component of neural tension. The classification of adverse neural tension may not have applied to these subjects; however, this study may shed some light on the possible preventative and curative capabilities of MRT® alone and in combination with neural mobilization techniques.

A well controlled study by Coppieters et al[15] looked at different test positions related to range of motion changes as well as sensory responses with neurodynamic testing. They chose the upper limb tension test one (ULTT1) with a median nerve emphasis to help answer some of their hypotheses. They discovered that compared to non-neural test positions, positioning the shoulder in a neurodynamic test position resulted in a decrease in elbow extension. Sensitizing the system even further led to greater range of motion deficits by adding contralateral cervical flexion or wrist extension or both at the same time. Their study highlighted the probability that structures (articular and muscles and their fascia)

Table 1. Shoulder Abduction Range of Motion Values Over the Course of Treatment (In Degrees)

June 10, 2002						June 21, 2002						July 2, 2002					
Subject 1		Subject 2		Subject 3		Subject 1		Subject 2		Subject 3		Subject 1		Subject 2		Subject 3	
MRT®		Neuro		MRT+Neuro		MRT®		Neuro		MRT+Neuro		MRT®		Neuro		MRT+Neuro	
R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L	R	L
8º	12º	10º	12º	5º	11º	14º	10º	17º	9º	20º	12º	25º	11º	19º	8º	29º	15º

other than the neural tissue can be excluded as a cause of limitation. They also recognized that this is at least a part of the answer and acknowledged that their had been no studies that investigated the relationship of the superficial and deep layers of the myofascia in the upper limb and cervical region.

Our study demonstrated that there is a strong influence on the soft tissue and related structures in addition to the neural components. The biggest gains in ROM occurred with MRT and with the combination of MRT and neural mobilization. On the other hand, the smallest gains in ROM occurred with neural mobilization alone. In addition to addressing the nervous system and its mechanical influence, we took it a step further to address the myofascial structures. Many textbooks and journal articles have described in detail the structure of nerves, muscles, and surrounding vessels. A common component to each of these structures involves connective tissue in various forms. Intuitively, we read this information and associate a connection to painful stimuli and the effectiveness of treatment. A strong argument can be made for the connection of the skin and superficial connective tissue to the nervous system.

The whole nervous system has a network of connective tissue that mesh together from the cranial dura to the sheath surrounding the peripheral nerves. Butler[11] describes a strong but sensitive connection between the surrounding somatic tissue and the neural tissue. He also adds that adaptations are made in the neural system based on fascicular structure, depth of the nerve and connection to the somatic tissue, and "neural containers." More recent theory also has paved new inroads into the blood supply and innervations of the nerves themselves. Many feeder vessels supply the peripheral nerves with a strong circulatory effect. Prolonged strain and compression of this system can lead to physiological changes that ultimately can contribute to painful stimuli.

Similar effects can be noted in the myofascial system. It is suspect to trauma, compression, immobilization, and strain. As Schultz and Feitis[16] discuss, the myofascia exists as layers between muscles connecting deeper muscles to more superficial muscles and adjacent muscles into groups. It is a layering of sheets of fibrous tissue that flows through the body, eddying around bony protuberances that compress and redirect its flow. Fascial fibers interpenetrate the muscle, wrapping around smaller muscle fiber groups and when the muscle fibers expand and contract, they exert internal pressure on this myofascial tissue. Basic human anatomy has taught us the innervation pattern of all the major muscle groups. This means that the nerves that innervate certain muscles are susceptible to this same compression. It also leads us to believe that various nerve pathways, especially where more superficial, can become comprised by this connective tissue medium.

We feel that because of this close relationship, the MRT treatment technique used by itself or with neural mobilization, enhances the treatment approach for adverse neural tension or other upper extremity symptoms compared to neural mobilization alone. We found that right shoulder ROM improved after the third and sixth treatment session and that less sensory responses were reported by those that had had MRT treatment. No clinically relevant ROM improvements in the left shoulder abduction were noted leading us to believe that the interventions on the right were significant and not related to chance.

We also realize the limitations of this study. Based on the small sample size, it is difficult to externally validate our findings to a larger population of clients. Using only 3 subjects does not reasonably state with any certainty that with the treatment of multiple clients similar findings would be present. It is important to pursue this pilot study using a larger sample size to make greater inroads into larger data output and what significance it may have in the clinical setting.

It was our intention of this study to help lead us to more avenues of research and expound on our existing findings as well as the existing literature related to our findings. The goal is to open up the very real possibility that the skin and fascial system play a much larger role in the treatment of upper extremity pain and symptoms than has previously been studied. In the current milieu of third party payors and insurance dilemmas, it is in our profession's best interest to find treatment techniques that are more efficient and efficacious. The clinical findings in this case study suggest improved patient outcomes with the use of MRT. However, due to limitation in sample size and experimental design, more research needs to be done in this area.

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