

The New York Pain Treatment Program Protocol

A Structured Physical Therapy Approach for Treating the Muscular Components of Chronic Pain Syndromes

Marek B. Wyszynski
The New York Pain Treatment Program
Lenox Hill Hospital
130 East 77th Street
New York, NY, 10121, USA
Phone 212-249 2200
Fax 212-535 6994

As of 2002 in New York City please contact
Physical Therapy & Feldenkrais NYC, PC
338 East 49th Street
New York, NY 11415
(646) 497-1480
(646) 497-1459
www.bettermovement.com
mail@bettermovement.com

Abstract

Although Myofascial Pain Syndrome (MPS) is the most common diagnosis for injured workers [1], there is no uniform description or definition of MPS in the medical literature. Often the phrase myofascial pain is used to describe a variety of difficult-to-classify pain syndromes, resulting in confused and contradictory treatment approaches. Correct diagnosis and successful treatment of patients suffering from MPS must be based on a firm understanding of the muscular component of Chronic Pain Syndromes. The New York Pain Treatment Program protocol in use at Lenox Hill Hospital is based on classification, diagnosis and treatment guidelines developed by Dr. Hans Kraus that recognize four types of muscle pain (tension, spasm, deficiency and trigger points).

It is the author hope that this presentation will assist other clinicians in developing optimal rehabilitation programs

Keywords: Myofascial Pain Syndrome; Muscle; Physical Therapy

1. Introduction

As physical therapists, we treat patients in a variety of settings- including hospitals, nursing homes, rehabilitation centers, outpatient clinics and patients' homes. The problem of pain, whether acute or chronic, is a significant part of our work. My colleagues and I at the New York Pain Treatment Program, having worked with and observed professionals in many settings who are involved in the treatment of pain, recognize that different medical disciplines often apply contradictory modalities, techniques and exercise regimens.

Depending on the background, preferences and experience of the physician or therapist, the same patient could receive dramatically different treatment. There is an almost unlimited variety of treatments for neck and back pain. These range from the application of modalities (i.e. heat/cold, electrotherapy, ultrasound, laser, short wave diathermy, traction) and the use of manual therapy (spinal mobilization and manipulation systems, different types of massage, Myofascial Release, Craniosacral Therapy or Muscle Energy techniques, etc.) to various exercise programs (McKenzie, Williams, Dynamic Spinal Stabilization, Muscle Imbalance System) and methods such as Feldenkrais or Alexander's technique. In addition, invasive procedures such as spinal surgery are available.

The lack of agreement about diagnosis and treatment among medical professionals who treat pain, and the inconsistency and the limitations of existing treatment guidelines (i.e. The Agency for Health Care Policy and Research clinical practice guideline #14 "Acute Low Back Problems In Adults" [2]), prompted the author to offer the solution we have found at the New York Pain Treatment Program at Lenox Hill Hospital. This article outlines the protocol developed by Dr. Hans Kraus. The protocol is a comprehensive, structured, physical therapy approach to the evaluation and treatment of muscular components of Chronic Pain Syndromes. In presenting this material, the emphasis is on the benefit of a structured approach-- in which specific treatments are given for specific diagnoses or dysfunction -- over the more commonly used non-structured approach, which often involves non-specific diagnoses (i.e. "low back pain") and the hit-or-miss application of treatment philosophies and methods that vary greatly in effectiveness, duration and costs.

One obstacle to the widespread acceptance of the structured approach has been the lack of precise diagnostic terminology. Although Myofascial Pain Syndrome (MPS) is the most common diagnosis for injured workers [1], there is no uniform description or definition of MPS in the medical literature.

Myofascial Pain Syndrome has been defined as a regional pain syndrome accompanied by trigger point(s). It is distinguished from Fibromyalgia Syndrome (FMS), which is characterized by widespread musculoskeletal pain and tenderness on palpation (tender points)[3]. Some sources use the terms synonymously[4]. MPS and FMS have similar symptoms, which were formerly (and occasionally still are) described as myalgia, fibrositis, myositis, myofasciitis, fibromyositis, myofibrositis, muscular strain, and nonarticular rheumatism [5] among other terms.

2. Principles of muscle pain

The philosophy of the New York Pain Treatment Program is based on the work of Hans Kraus, M.D., Associate Professor of Physical Medicine and Rehabilitation at New York University. An internationally-known expert on back ailments and the author of many papers and books, he served on several committees, including the President's Council on Youth Fitness and the Advisory Board of the Joint Legislative Committee on Sports and Physical Fitness in New York. Dr. Kraus's unique contribution has been to acknowledge the importance of treating the muscular component of Chronic Pain Syndromes [6]. According to Kraus there are four types of muscle pain:

- Muscle tension -- described as a prolonged contraction of a muscle or muscle group beyond functional or postural need, as a result of "fight or flight response". Muscle tension can be voluntarily released by relaxation or suggestion.
- Muscle spasm -- a painful contraction of striated muscle caused by chronic or acute trauma, excessive tension or organic disorders. Muscle spasm is an involuntary muscle contraction; the patient is unable to relax the muscle with relaxation or suggestion.
- Muscle deficiency
 - a. Lack of flexibility (stiffness) -- flexibility is defined as total elasticity of the muscle and consists of physiological elasticity, or ability of a muscle to let go of contraction, and mechanical elasticity, the ability of a muscle to yield to passive stretch.
 - b. Lack of strength (weakness) -- strength is defined as the ability of a muscle to contract and thereby overcome resistance, weight and gravity.
- Trigger points - small tender nodes of degenerated muscle tissue that may be dormant, producing no symptoms until unpredictable motion or pressure causes severe pain and muscle spasm. Trigger points develop after prolonged spasm or tension, and they can be the sequelae of chronic or acute trauma. In addition endocrine imbalance may produce generalized muscle pain and trigger points.

3. Physical Therapy evaluation and assessment of muscular origins of pain syndromes

A comprehensive physical therapy evaluation is essential for the development of an optimal rehabilitation program. The evaluation consists of the patient's history and a physical examination.

3.1. History

The patient's history plays a critical role in the development of a hypothesis about the origin of his or her pain. It includes current complaints and past medical and surgical history. The history reveals the patient's functional limitations and the nature of his or her symptoms. The subjective report is taken to identify the following:

- mechanism of initial onset (injury vs. non-injury, progressive worsening of the symptoms)
- potential sources of emotional tension
- pain level (analog scale or 0 - 10 at the time of evaluation and the worst/least pain during the last two weeks)
- response to previous treatments
- possible precautions (i.e. cardiac pacemakers, anticoagulation treatment, cardiovascular status, etc.)

3.2. Physical Examination

The first component of the physical examination is observation of the patient. This includes assessment of the posture in sitting and standing, observation of the patient's movements (transfers, gait, body mechanics and other functional movements during history taking). Any obvious deformity and scars should be noted. This part of the physical examination provides the practitioner with important information about areas of dysfunction, adaptation and compensatory patterns, as well as potential sources of postural tension and muscle imbalances.

The second component of the physical assessment is joint range of motion testing (ROM). Limitation in motion should be measured using a goniometer or inclinometer. The motion is tested actively (AROM) and, if restricted, passively (PROM). The joints in which limitation is present are tested at least three times actively. Prior to the second and third test the patient is instructed to relax during the movement. The ROM evaluation offers valuable, objective information, including:

- patient compliance and pain behavior (consistency of findings)
- ability of the patient to relax (Is the patient assisting with PROM even when instructed to “let go”)
- muscle tension may be diagnosed if results of AROM improve when the patient is instructed to perform the movement in more relaxed fashion
- muscle spasm may be suspected if worsening of results is found consistently after the first attempt and is accompanied with increase of the pain
- muscle stiffness may be suspected, if the motion is limited, and the relaxation as well as repetitions do not change the results in a significant way

Muscle strength and flexibility examination is designed to detect muscle deficiency. The strength of the muscles of the extremities is assessed by manual muscle testing with the use of Lovett Scale [7]. The Kraus-Weber test (See Kraus, Marcus, this journal, for details) is utilized for evaluating the strength and flexibility of the key postural muscles. Elasticity of the hamstring muscles is assessed by passive single leg raise (an 80 degree angle between the table and the leg is considered normal); elasticity of hamstrings and gluteal muscles is determined by a bilateral passive leg raise (a normal result is a 35 degree angle between the legs and the table), flexibility of the hip flexors is evaluated with the Thomas test.[8]

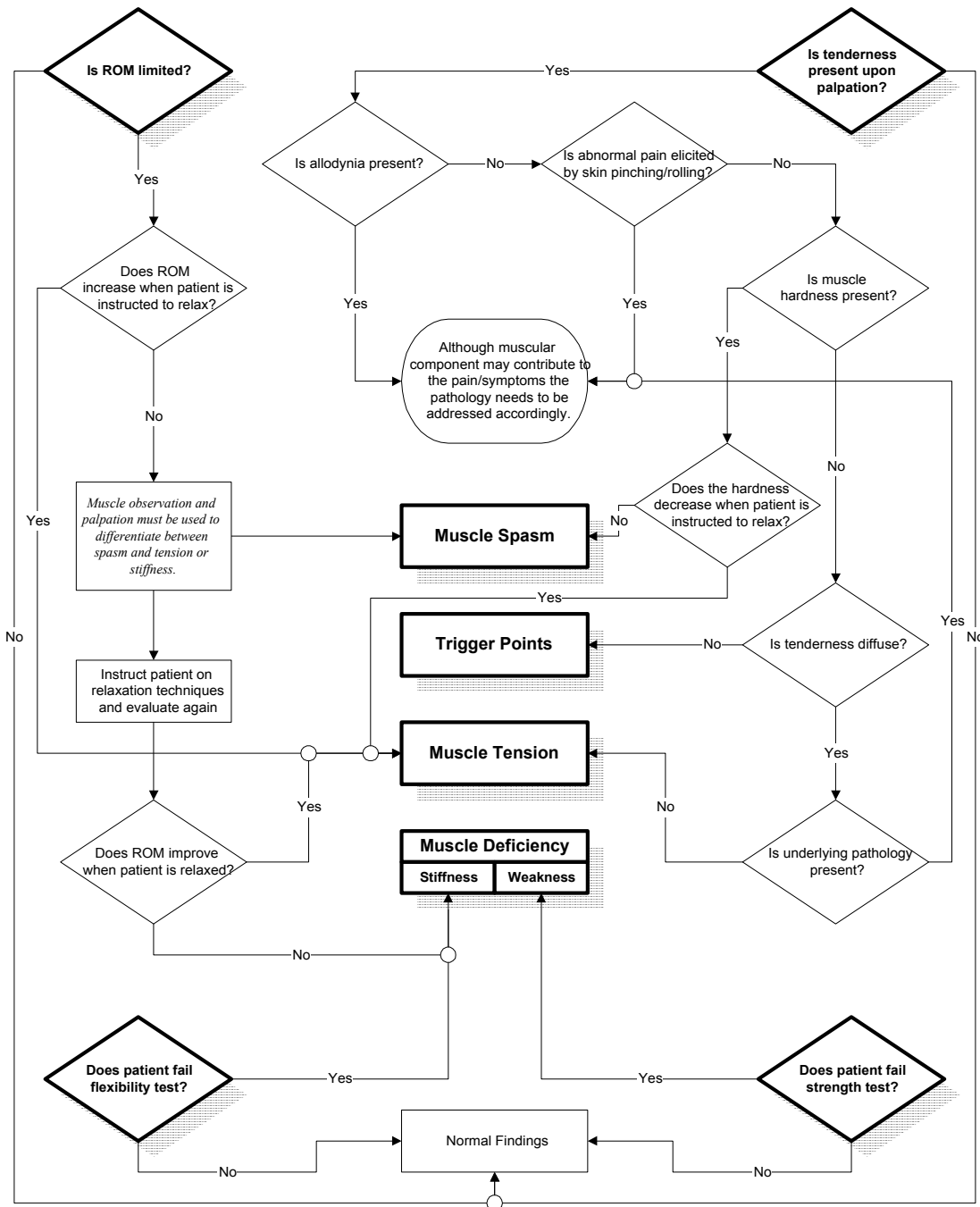
Palpation of subcutaneous and deep tissues is a significant part of the physical examination. Muscle hardness, or bulkiness is a manifestation of increased tone, which is present in muscle tension and spasm. To differentiate between muscle tension and spasm, the patient is asked to “relax and let go”. In the case of muscle tension, the clinician will be able to palpate a change in muscle tone (the tissues will soften as the patient relaxes). With muscle spasm no significant change will be detected. Through palpation the clinician is also able to evaluate tissue tenderness. Gentle touch is used to determine the presence of allodynia (pain due to a stimulus that does not normally provoke pain)[5]. If no allodynia is found, skin and subcutaneous tissues are evaluated by a skin roll test, skin pinching and squeezing. Abnormal pain is a sign of Subcutaneous Pain Syndrome, previously called fibrositis [9]. Both allodynia, and Subcutaneous Pain Syndrome are non-muscular dysfunctions. Therefore their clinical implications are beyond the scope of this article. Evaluation of deep tissues allows the clinician to differentiate between local and diffuse tenderness. Local tenderness may indicate the presence of trigger point(s). A local “twitch response” (a muscle or skin twitch) may be visible when the trigger point is palpated. [10]. Often trigger points are localized in firm “taut bands” of muscle fibers surrounded by normal muscle tissue[11]. Patterns of referred pain are frequently identified upon palpation[8]. Observation and evaluation of the patient's response to the muscle contraction (i.e. during therapeutic exercise, specific movement or electrical stimulation) may be diagnostically suggestive. Typically the patient will report a consistent increase of pain when the muscle containing a trigger point contracts (irritation of the trigger point). Diffuse multiple tender points may indicate endocrine imbalance, a psychological problem or fibromyalgia (if found in specific areas and accompanied by other symptoms). Algometry is a valuable asset in the evaluation of tenderness. Pain threshold and tolerance can be objectively quantified by using a pressure gauge (dolorimeter). Analysis and comparison of the pain threshold of the muscles on opposite sides of the body may offer

important findings. A threshold reading of 2 kG/cm² less than the opposite (normal) area or adjacent, non-tender spot indicates abnormal sensitivity[12].

Finally the patient's functional status is assessed. This includes the evaluation of balance, coordination, and transfers as well as a tolerance to and limitation of activities of daily living.

Figure1. Physical examination

The four basic examination procedures are located at the four corners leading to diagnoses in the central column.



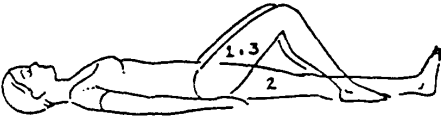

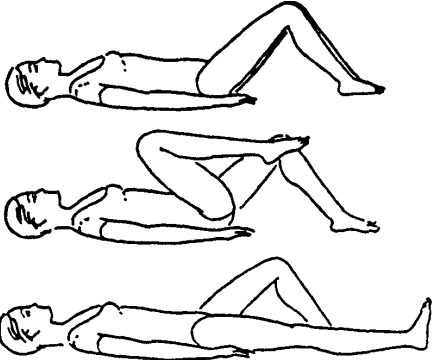


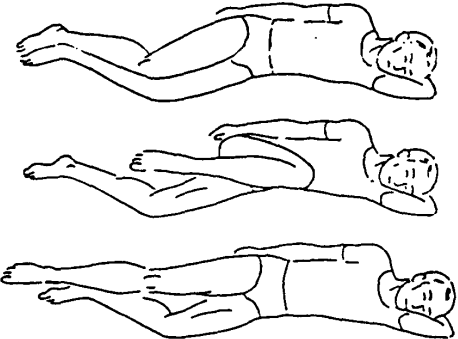

4. Physical Therapy treatment of muscle pain

4.1. Muscle tension

Tension is a muscle contraction that can be voluntarily released by relaxation or suggestion. The treatment of muscle tension includes diaphragmatic breathing, Jacobson's Progressive Relaxation [13] and other forms of relaxation training based on visualization techniques [14]. The first part (Level 1) of the exercise program designed by Dr. Kraus is relaxation and limbering training (Fig. 2).

Figure 2. Kraus Exercise Program Level 1 (Figures from Kraus [15])

	<p>1. Diaphragmatic Breathing</p> <p>Inhale through your nose (belly gets round). Exhale slowly through your mouth.</p>
	<p>2. Shoulder Shrugs</p> <p>Pull your shoulders up toward your ears. Inhale and exhale as you let go.</p>
	<p>3. Leg Slides</p> <p>Slide your leg all the way down. Relax and let it go. Slide it back to the basic position. Repeat with the opposite leg.</p>
	<p>4. Head Rotations</p> <p>Drop your head to the right side, return back to neutral and let go, then drop the head to the left side and back to center.</p>
	<p>5. Single Knee To Chest</p> <p>Begin in the basic position. Bring one knee to the chest as far as you can comfortably. Lower the foot to the floor, then slide your leg down and let it go. Slide the leg back to the basic position. Repeat with the opposite leg.</p>

	<p>6. Sidelying Knee To Chest</p> <p>Lie on your side in the fetal position. Bring your upper leg toward your chest, letting the knee drop toward the floor like dead weight. Then slide the leg back, extending the knee. Bring the leg back to starting position and let it go. Do this 3 times, then roll onto your other side and repeat with opposite leg.</p>
	<p>7. Buttocks Squeeze</p> <p>Turn onto your stomach and place a pillow under your belly. Tighten your seat muscles and hold for 2 seconds. Relax and let go.</p>

Cardiovascular conditioning exercises (stationary bike, treadmill, upper body ergometer) can also be effective methods of tension release. These exercises are used only if the patient is able to perform them without any increase of symptoms. Proper warm-up (including relaxation and limbering exercises) and cool-down (limbering and finishing the session with relaxation) are important elements of conditioning.

Education of the patient on the prevention of postural tension (body mechanics classes, back and neck school) is also a significant part of the treatment.

Optional treatment may include the use of physical agents (superficial and deep heat modalities) and manual therapy (relaxation effect of hands-on techniques, i.e. Soft Tissue Massage, Myofascial Release, Craniosacral Therapy).

During the course of the three week program at the New York Pain Treatment Program at Lenox Hill Hospital the muscle tension component of Chronic Pain Syndromes is also addressed by Feldenkrais, Awareness Through Movement classes [16]. These classes help patients to improve their awareness and eliminate self-defeating habits such as clenching teeth, pulling shoulders, holding breath, tensing the belly, and other unnecessary efforts or “holding patterns”.

Pharmacological management as well as psychological support and biofeedback are also used when appropriate.

4.2. Muscle spasm

Spasm is an involuntary muscle contraction, in which the patient is unable to release the contraction with relaxation or suggestion. The New York Pain Treatment Program protocol for the treatment of muscle spasm includes the use of cold packs (10 minutes to the involved area) followed by electrical stimulation. Clinical experience suggests the use of continuous mode (tetanizing) electrical stimulation prior to exercising modes (i.e. surged or pulsed)[17]. Therefore, our protocol includes tetanizing the target muscle with continuous, alternating current at a rate of 50 Hz for 10 minutes to fatigue the muscle. This is followed by sinusoid surging current administered at a rate of 50 Hz for 10 minutes, 2 seconds on-time and 2 seconds off-time to increase blood flow (pumping effect), muscle contraction and relaxation. After electric stimulation, the patient performs the relaxation and limbering exercises. The Kraus program, level one, is recommended for spasms of the lower extremities and back muscles in the lower quadrant (Fig. 2). Upper quadrant limbering exercises are utilized for the treatment of spasms of the neck and upper extremities musculature (Fig. 3). Painful areas are sprayed with a vapocoolant (Fluro-Ethyl or Ethyl Chloride) which allows the patient to increase pain-free range of movement. In order to avoid pain and

fatigue, the patient performs three-to-four repetitions of each exercise. Properly executed movements, a slow pace, and pauses between repetitions (for relaxation) are crucial to the success of the treatment.





These treatments are administered daily for acute cases and two-to-three times a week for subacute and chronic muscle spasm until the patient achieves an optimal functional level.

Another method of the treatment of muscle spasm is the Strain/Counterstrain method. This method was developed by Lawrence H. Jones, D.O., FAAO. Strain and Counterstrain is a passive positional procedure that places the body in the position of greatest comfort. The muscle spasm and pain are relieved by reduction and arrest of inappropriate proprioceptor activity [18].

4.3. Muscle deficiency

Muscle weakness and stiffness are successfully treated with exercise. The protocol used at the New York Pain Treatment Program includes the Kraus exercises (3 levels) and/or upper quadrant limbering exercises (Fig. 3). The patient gradually progresses through the phases (relaxation, limbering, stretching and, finally, strengthening). The exercise regimen is geared to individual needs, and the decision as to how soon the patient can be advanced to the next phase depends on the individual's overall progress. Typically, in the first week of the program, the patient performs Level 1 exercises only (Fig. 2). Level 2 exercises are introduced in week two, and level 3 exercises are added during the 5th week of the rehabilitation course (Fig. 4, 5). Each exercise is repeated three times. Each session begins and ends with relaxation and limbering (for example, the patient performs exercises 1 through 21 then reverses the order 21 through 1). The series is done once or twice a day. Exercises should be performed in a slow, careful manner. The relaxation and rest period between each repetition is of utmost importance for the success of the treatment. Finally, strengthening exercises, first with manual resistance and then with free weights, may be introduced. Any exercise that causes discomfort should be modified or discontinued.

Figure 3. Upper quadrant limbering exercises

	<p>1. Diaphragmatic Breathing</p> <p>Inhale through your nose (the belly gets round), exhale slowly through your mouth.</p>
	<p>2. Shoulder Shrugs</p> <p>As you are inhaling pull your shoulders up toward your ears, exhale and let go.</p>
	<p>3. Head Rotations</p> <p>Drop your head to the right side, return back to neutral and let go, then drop the head to the left side and back to center.</p>
	<p>4. Elbow Bend</p> <p>As you are inhaling close fists and bend elbows, as you are exhaling - let go.</p>

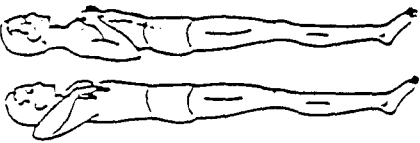
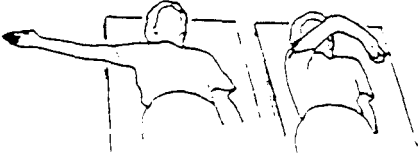
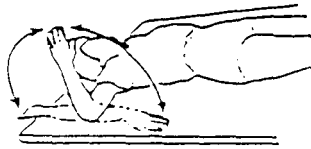

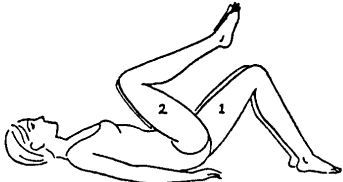
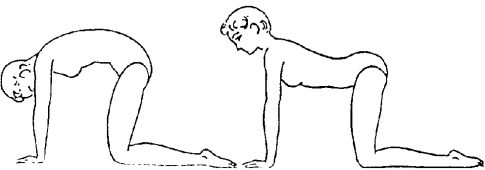
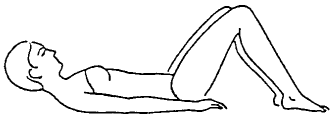
	<p>5. “Chicken Wings” Basic position with hands on the chest. Abduct the arms.</p>
	<p>6. Horizontal Abduction - Adduction Bring the arm across the chest and bring it back (out to the side).</p>
	<p>7. Shoulder Rotation Abduct the arm with elbow flexed. Rotate in and out.</p>
	<p>8. Shoulder Bend In basic position elevate your arms with elbows straight, up above the head during the inhale. Return back to basic position on the exhale. If it is too difficult or painful, lower both hands and let the strong/less painful side assist with raising and lowering the arms.</p>

Figure 4. Kraus Exercise Program Level 2 (Figures from Kraus [15])

	<p>8. Double Knee To Chest Start in the basic position. Inhale, and as you exhale, bring both knees up toward the chest. Then slowly lower your feet back to the basic position.</p>
	<p>9. Cat Back Assume a kneeling position, resting on your hands and knees. Round your back and let your head drop at the same time. Then arch your back and lift your head upward.</p>
	<p>10. Partial Sit-up Start in the basic position and place your hands on the front of your thighs. Inhale, and as you exhale, raise your head and shoulders off the floor and slide your hands along your thighs. Slowly lower yourself back to the basic position.</p>


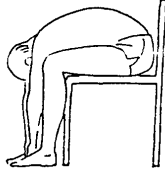
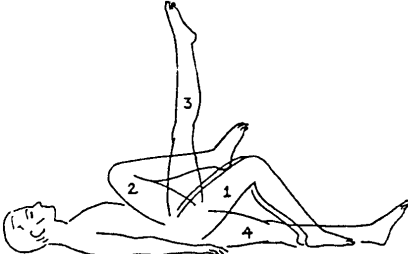


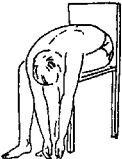
	<p>11. Pectoral Stretch</p> <p>Start in a kneeling position and bring your buttocks back toward your heels. Slide your hands forward as far as you can, keeping your head in line with your arms. Return to starting position.</p>
	<p>12. Seated Bend</p> <p>Sit forward in a chair, with your feet apart on the floor. Inhale, and as you exhale, let your head drop and roll yourself down, reaching with your hands in between your knees. Go as far as you can comfortably, then slowly roll up to starting position.</p>
	<p>13. Bicycle Hamstring Stretch I</p> <p>Begin in the basic position. Bring one knee to the chest as far as you can comfortably. Straighten the leg, with the toes pointed toward the ceiling. Keep your toes pointed and knee straight as you slowly lower your leg to the floor. Relax and let the leg go. Slide the leg back to the basic position. Repeat the exercise with the opposite leg.</p>
	<p>14. Bicycle Hamstring Stretch II</p> <p>Begin in the basic position. Bring one knee to the chest as far as you can comfortably. Straighten the leg, this time with the heel pointed toward the ceiling. Maintain the heel position and knee straight as you slowly lower your leg to the floor. Relax and let the leg go. Slide the leg back to the basic position. Repeat the exercise with the opposite leg.</p>

Figure 5. Kraus Exercise Program Level 3 (Figures from Kraus [15])

	<p>15. Full Sit-up</p> <p>Begin in the basic position. Tuck your feet under a heavy object (such as the base of a couch or bed), so they are stabilized. Place your hands on either side of your face, unless otherwise instructed by your therapist. Inhale, and as you exhale, roll to full sit-up. Roll back to the basic position.</p>
	<p>16. Seated Bend With Rotation</p> <p>Sit forward in a chair, with your feet flat on the floor. Inhale, and as you exhale, let your head drop and roll your trunk down to the left. Go as far as you can comfortably, then slowly roll up to sitting. Repeat, this time bending to the right.</p>

	<p>17. Straight Leg Raise Hamstring Stretch I</p> <p>Begin in the basic position. Slide one leg all the way down and point the toes away from your head. Keeping the knee straight, raise the leg as high as you can comfortably. Lower the straight leg to the floor and let it go. Slide the leg back to the basic position. Repeat the exercise with the opposite leg.</p>
	<p>18. Straight Leg Raise Hamstring Stretch II</p> <p>Begin in the basic position. Slide one leg all the way down. Keeping the knee straight, raise the leg as high as you can comfortably while you point the heel toward the ceiling. Maintain the foot position as you lower the straight leg to the floor. Relax and let the leg go. Slide the leg back to the basic position. Repeat the exercise with the opposite leg.</p>
	<p>19. Diver's Bend</p> <p>Stand with your feet slightly apart. Clasp your hands behind your back. Bend forward from the hips, keeping your back, neck and knees straight. Go down as far as you can, then raise your head until you feel stretching in the back of your legs. Bend your knees slightly as you return to standing.</p>
	<p>20. Calf Stretch</p> <p>Stand facing a wall, and place your palms on the wall. Bend your elbows so that you are leaning forward, keeping your back and hips straight. Make sure your heels stay on the floor. You should experience a stretch on your calf muscles. Straighten your arms to push your body back to standing erect.</p>
	<p>21. Standing Bend</p> <p>Stand with your feet together and knees straight. Inhale, and as you exhale, let your head drop and roll yourself down as far as you can comfortably. Bend your knees and slowly roll back up to standing.</p>

4.4. Trigger points

The physical therapy management of Trigger Points is divided into two periods. If Trigger Point pain is present for less than six weeks, the treatment consists of a series of deep point massages (four-to-six sessions). After the initial course of treatment, the patient is re-evaluated. In the case of a lack of progress, Trigger Point injections may be recommended.

The individual is instructed on post-Trigger Point Injection management (this may consist of gait training with an assistive device, and specific precautions related to physical activities after the injections). The post-Trigger Point Injection Physical Therapy protocol includes cold packs for 10 minutes to the injected area, electrical stimulation (sinusoid, surging current at a rate of 50 Hz, 2 seconds on-time, 2 seconds off-time for 15 minutes). Electrodes are placed on the injected muscle-belly or motor points. The electrical stimulation treatment is followed by limbering exercises (Kraus Level 1, or upper quadrant limbering).

Vapocoolant spray is used to increase pain-free range of motion. Active-assistive exercises are done when a patient is unable to perform pain-free, active movements. The patient receives physical therapy follow-up treatment on three successive days after each injection.

5. Conclusion

The Kraus philosophy is unique in addressing muscles as a primary cause of pain as well as in its systematic analysis of the types of muscle pain and comprehensive approach to treating them. Muscle treatment with its accompanying exercise program may seem too simple to be an effective method of back pain management, yet statistical figures have proven otherwise. A study involving 11,809 subjects showed that 80.7% of the participants reported pain reduction in 6 weeks. An improvement in flexibility and strength of the key postural muscles was also noted (82.6% of patients showed improved performance on Kraus-Weber test) [19]. A small number of repetitions of each exercise proved to be sufficient for increasing muscle strength and flexibility. Patients, who otherwise could not withstand the typical exercise programs used at many other pain treatment facilities, were enabled to exercise successfully through implementation of a specific muscular diagnosis and treatment. Validity and reliability studies of these concepts and techniques are currently underway.

The methods presented in this article are easy to apply in almost any physical therapy practice. These techniques do not require sophisticated equipment, are relatively inexpensive, and can be successfully used by any physical therapist.

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