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Review Article

TRAUMA AND CHRONIC SOFT TISSUE PAIN

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Abstract. As few as 12% of patients who have sustained soft-tissue injuries of the neck recover completely, and residual symptoms are problematic for the clinician and patient alike. The persistence of soft tissue pain often leads to the development of chronic myofascial pain syndrome and fibromyalgia. A diagnosis of myofascial pain syndrome is confirmed upon physical examination with objective findings including the presence of trigger points, taut myofascial bands, and local twitch responses of the taut bands. Fibromyalgia is a chronic soft tissue rheumatic disorder characterized by widespread musculoskeletal pain associated with a deficiency of deep sleep, headaches, fatigue, and decreased stamina. Diagnostic criteria include, in addition to widespread pain for at least three months, a finding of at least 11 of 18 typical tender points in specific anatomic areas.
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The assessment and treatment of patients who have sustained injuries to soft tissue, at times, can be difficult, particularly when their pain lasts more than a few months. Most commonly, such injuries resolve with conservative treatment and “tincture of time.” However, a minority of these patients are left with persistent pain that is often difficult to treat (1,2) and the cause of much frustration, psychological distress, and even depression (3). This is especially worrisome to the patient as economic pressures mount due to lost wages, unpaid medical bills, and, in some cases, the transition to disability status.

Why is it that some patients involved in motor vehicle accident induced whiplash recover fully, while others do not? Why is it that some patients develop chronic post-traumatic headaches while others involved in similar traumas do not? And why is it that some patients develop fibromyalgia (FM) or myofascial pain syndromes (MPS) after traumatic events and others do not? While the answers to these questions may never be definitively determined, it should not surprise clinicians that because we are all unique, distinct organisms, the responses to trauma may be varied. The principle of biodiversity *(4,5)* may help explain why some people who sustain soft tissue injury have short-lived symptoms while others develop chronic painful and even debilitating problems. The bottom-line is that we are all distinct individuals with unique, albeit similar, responses to various stimuli including trauma.

For example, many patients suffer neck pain for long periods after a trauma, such as that caused by a motor vehicle accident, despite having normal cervical spine x-rays. The development of this type of chronic soft tissue pain has been explained, in part, by the large degree of biological variability among accident victims (6). Nor were persistent symptoms post-

trauma limited to neck pain. Cognitive deficits (7) and headaches (8) have been shown to accompany cervical injuries. So have such disorders as MPS (9) and FM (10).

Persistent symptoms after whiplash injuries have been the subject of several review articles (11-13) and books (14-16). Various factors have been demonstrated to influence long-term outcomes. A statistically significant positive correlation has been shown to exist between poor prognosis (i.e., chronic pain and impairment) and the following findings shortly after the trauma: numbness and/or pain in either arm, sharp reversal of the cervical lordosis as demonstrated on
cervical spine x-ray, need for a cervical collar for more than twelve weeks or need for home traction, or need to resume physical therapy more than once because of a recurrence of symptoms (17).

This early study (17) also showed that recovery occurred in only *57%* of patients after *5-6* years. Degenerative changes developed after the injury in 39%. A later study (18) with a longer follow-up period (mean 10.8 years) revealed that only 12% of patients who had sustained soft-tissue injuries of the neck recovered completely. The authors reported that residual symptoms were "intrusive" in 28% and "severe" in 12%. They further noted that after two years from the date of the trauma, symptoms did not tend to alter with the further passage of time. This persistence of soft tissue pain seems to lead to the development of chronic MPS and even FM. Table I lists common soft tissue problems caused by physical trauma. The following discussion focuses on chronic MPS and FM, as these conditions are more common than originally thought and have the potential to cause significant impairment and suffering.

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Table I. Common soft tissue problems post-trauma.

Acute	Chronic
Musculoligamentous sprain (most common) Muscle spasms Strains Adhesive capsulitis (typically of shoulder) Contusions Bursitis Contractures Tendinitis (usually after repetitive "micro trauma") Capsulitis	Myofascial pain syndrome Fibromyalgia syndrome Adhesive capsulitis (typically of shoulder) Persistent strains (often with poor posture) Contractures

MYOFASCIAL PAIN SYNDROME

The diagnosis of MPS is based on complaints of pain and the detection of objective abnormalities upon careful physical examination. These objective findings include the presence

of trigger points, taut myofascial bands, and local twitch responses of the taut bands (9,19). Characteristic objectively demonstrable electrical activity of trigger points can b measured by the needle electromyogram (EMG) (20,21). Furthermore, muscle spasm and dysfunction often can be observed using surface EMG testing (22). Another way the clinician can demonstrate the presence of MPS is to use an instrument known as a tissue compliance meter. This device is a hand-held mechanical instrument which can measure changes in the tone and form of soft issue (23). It is lightweight, portable, and easy to use, even by a busy clinician in the often hectic environment of many clinics and private offices. The instrument allows the clinician to measure the distance in millimeters that a probe compresses into (or deforms) the soft tissue as a function of force in kilograms. The harder the tissue, the less deformable it is and the lower its compliance. Since increased resistance or harder soft tissue consistency in the form of a taut myofascial band is consistent with MPS (9) the presence of such hardness or decreased compliance can be objectively demonstrated by tissue compliance measurement. It is important to note that, since soft tissue injury is much more difficult to appreciate using standard imaging techniques, the clinician should rely on other methods to objectively measure the soft tissue with respect to trigger points and taut bands as previously noted.

The role of trauma in the generation and perpetuation of trigger points, long known to be the hallmark physical findings of MPS, was perhaps most succinctly stated by Rachlin (24). “Injuries and surgical procedures may lead to the formation of trigger points causing repeated episodes of pain.”

The worst cases of MPS seem to be the result of traumatic events as an automobile accident or fall. Simons (19) noted that such patients “suffer greatly and are difficult to help.” He went on to write, “They exhibit a post-traumatic hyperirritability of their nervous system and of their trigger points.” The trauma in question, according to Simons, is “severe enough to damage the sensory pathways of the central nervous system.” In a study of Israeli trauma victims (10) investigators suggested that the reason FM followed neck injury thirteen-times more often than lower extremity injury was because of this very mechanism. The involvement of the nervous system probably is very important in the perpetuation and prolongation of the pain, thus preventing full recovery. Simons (19) opined that damage to the nervous system “...apparently acts as an endogenous perpetuating factor susceptible to augmentation by severe pain, additional trauma, vibration, loud noises, prolonged physical activity, and emotional stress.” In describing the patients who developed such severe MPS, Simons noted that “From the date of the trauma, coping with pain typically becomes the focus of life for these patients who previously paid little attention to pain. They are unable to increase their activity substantially without increasing their pain level.” Once the nervous system exhibits post-traumatic hyperirritability or other perpetuating factors which exist and are left untreated, “an acute myofascial pain syndrome characteristically becomes chronic.”

The concept of perpetuating factors has been known for many years (9), yet many patients who have severe, chronic MPS, often post-trauma, are met with skepticism and even disbelief. Bayer (25) wrote that “It is amazing if not amusing that insurers and their attorneys cannot believe that a patient who has suffered an injury can continue to experience symptoms of pain months or years after the injury.”

FM, previously termed *fibrositis,* is a chronic soft tissue rheumatic disorder characterized by widespread musculoskeletal pain associated with a deficiency of deep sleep *(i.e.,* stage 4, non-REM, delta wave sleep), headaches, fatigue, decreased stamina, and other symptoms (2). A

committee appointed by the American College of Rheumatology (ACR) of which this author was privileged to be a member published FM criteria (28) which are still in use today, not only in the United States but worldwide. The ACR criteria state that in addition to widespread pain for at least three months, the patient with FM needs to have at least 11 of 18 typical tender points in specific anatomic areas *(i.e.,* bilateral occiput, low cervical, trapezius, supraspinatus, 2nd rib, lateral humeral epicondyle, medial knee fat pad, gluteus medius, greater femoral trochanteric bursa) when the examiner palpates with a force of 4 kg (8.8 lbs). When these criteria are applied, they have a high degree of sensitivity (>88%) and specificity (> 8 1%). FM is a condition that can exist with other problems; therefore, a diagnosis of FM is not a diagnosis of exclusion. Often, patients with FM have MPS, arthritis, or other typically chronic conditions.

FM can result as a consequence of local muscular injury such as that which might be sustained in a fall or motor vehicle accident (28-3 1). Certainly, FM does not develop after all or even most traumatic events, but it can evolve after such traumas as physical assaults, motor vehicle accidents, and/or falls. FM takes at least 3 months to evolve according to ACR criteria (28). Thus, FM does not occur at the exact time of the trauma, but rather can develop weeks to months later as a direct consequence of the trauma. The real question confronting the clinician and about which the clinician may need to offer legal testimony is whether a specific trauma caused a specific FM in a specific patient at a specific time. In order to determine that, a careful record review, a thorough medical history, and physical examination must be obtained so that a conclusion based on the facts as opposed to prejudice or bias can be reached.

FM is always a chronic condition (32-34), and MPS often becomes chronic if perpetuating factors remain operative. While the treatment of FM can result in diminution of symptoms with resultant clinical improvement, albeit temporary, a cure, thus far, has not been forthcoming. It has been reported that cost of treatment of FMS patients is substantial (34); and FMS can be disabling (31, 35).

Since FM is always chronic and MPS often results in long-standing soft tissue pain, therapy needs to be ongoing. Table II outlines a reasonable treatment strategy. Before initiating treatment for either condition, the clinician should allot adequate time for a conference with patients for the purposes of explaining in detail exactly what these soft tissue problems are, and what they are not. Since the pain is often intense with periods of exacerbations, some patients may fear that they actually have a potentially crippling arthritic condition or even bone cancer.

Once the patients have been thoroughly informed of the nature of their problems, an exhaustive search for possible perpetuating factors should be undertaken. These include but are not limited to electrolyte imbalances, endocrine problems, vitamin deficiencies or excesses, poor posture, concomitant arthritic conditions, psychological problems, and/or other disease states. Once the perpetuating factor(s) have been eliminated or ameliorated, a more focused treatment plan can be more successfully implemented (9).

The treatment of MPS typically consists of oral medications such as muscle relaxants *(e.g.,* cyclobenzaprine 10 to 30 mg orally at bedtime, carisoprodol 350 rug orally at bedtime, orphenadrine citrate100 mg orally twice daily, tizanadine 2 to 4 mg orally 2-3 times daily, or the like); analgesics *(e.g.,* tramadol 50 to 100 mg every 4-6 hours as needed, propoxyphene 50 to 100 mg with acetaminophen 325-500 mg, or the like); nonsteroidal anti-inflammatory medications *(e.g.,* celecoxib 100-200 mg 1-2 times daily, rofecoxib 25-50 mg 1-2 times daily, meloxicam 7.5 mg 1-2 times daily alone otin combination). In addition to oral medications, the

clinician may need to employ such physical modalities as massage therapy, spray and stretch techniques using such topical coolants as ethyl chloride, and/or trigger point injections with 1% procaine or 1% lidocaine (34). Furthermore, some patients may benefit from a cognitive behavioral approach to pain management utilizing such modalities as biofeedback and pain imaging. A graded exercise program may also be beneficial, but care must be taken to avoid repetitive motion affecting the muscle or muscle groups most affected by the MPS.

Table II. Treatment strategy for MPS and FM.

A. Patient Education	**F. Manipulative Techniques**
	massage therapy
B. Identify and Correct Perpetuating Factors	physical therapy
poor posture	chiropractic care
electrolyte imbalances	
hormone deficiencies	**G. Injection Therapy**
	trigger points
C. Correct Sleep Disorder (if present)	tender points
sleep hygiene	intraarticular
avoid stimulants *(e.g.,* caffeine)	other *(e.g.,* bursa, tendon, ligament)
sedatives – tricyclics, others	
	H. Acupuncture
D. Oral Analgesics	
NSAIDS (for analgesic properties)	**I. Therapeutic Exercise**
tramadol	water aerobics
propoxyphene	stretching
short acting opioids	tai chi
long acting opioids	
other	**J. Other**
	biofeedback
E. Topical Preparations/Liniments	relaxation techniques
capsaictn	neuromuscular re-education
combination preparations	meditation/yoga
ethyl chloride/spray and stretch	pain imaging
	fentanyl patch

Patients with FM can be treated in a manner very similar to those with MPS, but the therapy should place an emphasis on correcting the stage 4, non-REM sleep deficit. Tricyclic antidepressants have been shown to be helpful in FM treatment, especially in rectifying the sleep disorder (37). Topical preparations have also been demonstrated to be effective in the treatment of the soft tissue pain in patients with FM (38,39). When FM occurs as a consequence of trauma, it tends to be more severe requiring more physician visits and causing more disability (31). The term *resistant fibromyalgia* (40) has been used to describe a particularly severe form which this author tends to see most commonly in those patients who have developed FM post-trauma. These patients are particularly hard to treat since they tend to be complex, have suffered from FM for a long period of time, and are plagued by many perpetuating factors and/or comorbid conditions.

Thus, regardless of the specific nature of the trauma, chronic conditions characterized by soft

tissue pain such as MPS and FM can develop, necessitating the need for future care. Typically this treatment would include office visits, oral medications *(e.g.,* muscle relaxants, analgesics), topical preparations *(e.g.,* liniments), local injections, physical modalities *(e.g.,* massage therapy, manipulation, adjustment) blood tests to determine if the oral medications were causing side effects, in addition to the amelioration of perpetuating factors. The patients need to understand that they need to make certain lifestyle changes to help optimize the medical treatment. These may include a change in employment or ergonomic modification of the work place environment. Many, if not all, patients must give-up or drastically reduce their use of alcohol, nicotine, and/or caffeine. This is especially true if a sleep disorder is resistant to pharmacologic treatment and behavior modification. Psychological problems such as depression, which often accompanies chronic pain, must be dealt with effectively. The patients need to set limits on their activities and learn to say *no* to unreasonable requests from family and friends, especially those who tend to minimize the patients' suffering.

There is no "magic bullet" that can be used in all patients with FM. Treatment must be individualized. It may take some time to arrive at the best treatment plan with the pain practitioner often having to rely on help from other health care professionals *(e.g.,* psychologists, acupuncturists, physical therapists, massage therapists). A multidisciplinary/ interdisciplinary approach (41) often is the only way to effectively treat some FM patients, typically those with resistant FM (40).

MEDICO-LEGAL MATTERS

Any article concerning chronic soft tissue pain caused by trauma is wanting if there were no mention of the interface between clinic and courtroom. As an important member of the community, the health care professional should get involved in civic matters. The medical/legal arena is no exception, especially if the litigant in question is being actively treated. The treating clinician should educate the court since that clinician has unique insights and knowledge concerning the nature and severity of his patient's problem.

If the clinician has knowledge concerning a patient's medical condition that would benefit the court, the practitioner has a duty to present that knowledge at the proper time whether it be in the form of a deposition or as an expert witness giving testimony in a courtroom. This author is not alone in this opinion. As a member of the American Medical Association and as a Fellow of the American College of Physicians, this author is privy to the ethics manuals of each group (42,43) and has reviewed each carefully. Both publications clearly state that if the physician has knowledge that can be useful to the court, it is considered his/her duty to present such knowledge when asked. Health care practitioners have an ethical duty to get involved if they have useful information. At times, a clinician is asked to perform a medical evaluation for the purpose of rendering an opinion only. The clinician should strive to be as objective as possible, relying on established criteria for FS (28) and MPS (9), as well as performing such testing as necessary to demonstrate or rule-out objective abnormalities (21-23).

When asked to respond to inquires from attorneys, the practitioner needs to keep in mind that the court is not interested in "may be" or "could be" answers. The court wants to know whether a patient has a particular condition as a result of a particular trauma to a reasonable degree of medical probability. That means that it is more likely than not that the trauma in question caused the patient to develop a medical problem for which the patient is being treated. For example, did the motor vehicle accident of three years ago cause the patient to develop MPS and/or FM?

One need not know with one hundred percent certainty that a given trauma caused a patient's medical problem in question, but based on the clinician's education, training, and experience, the clinician often can give an opinion — to a reasonable degree of medical probability — as to whether or not the trauma in question caused a patient's injuries. This is an important concept and one which is often lost on academicians and scientists who are use to expressing their thoughts to a degree of certainty approaching 95% to 100%.

The court is especially interested in the objective findings that help form the basis of the opinions rendered. Having performed a range of motion and/or a trigger point examination, the clinician in the role of expert witness must stress that such findings on physical examination are objective. Other objective findings include muscle spasm, jump signs, swelling, discoloration (especially reticular skin changes), taut myofascial bands, muscle atrophy, asymmetry of muscle size or strength, and deep tendon reflex abnormalities. The greater the skill of the examiner, the more likely such abnormalities will be observed and recorded.

Not every medical practitioner receives sufficient training in the diagnosis and treatment of FM and MPS. For example, a physiatrist or rheumatologist is more likely to be thus trained as opposed to other specialists whose training tends to focus on acute rather than chronic painful problems. Thus, many clinicians do not have the required expertise to perform a FM tender point count or a MPS trigger point exam despite being quite otherwise capable in their respective fields. According to Simons (19), the diagnosis of FS and/or MPS "...would probably be missed on routine conventional examination. The examiner must know precisely what to look for, how to look for it, and then must actually be looking for it." Is it any wonder that patients who have been diagnosed with either FM and/or MPS are sent by insurance companies to doctors with little or no experience in the diagnosis of these disorders? This author has witnessed this practice over and over again. This just tends to muddy the water and does an injustice to the patient.

However, it is within the expertise of the knowledgeable clinician to be diligent in taking a medical history, circumspect in reviewing pertinent medical records and thorough in performing a physical examination so that he/she can make an accurate diagnosis in the office and explain the salient findings in legal proceedings. What is wrong with the best trained and most skilled examiners testifying in court? It appears to be in the best interest of the insurance companies to place blame on the patient *(25)* and to ignore important facts about MPS and/or FM as well as other important details about those individuals suffering from disorders stemming from a traumatic event.

The clinician as an expert witness must not take sides in a personal injury lawsuit. The expert must be honest, truthful, and professional at all times. However, having been sworn to tell the whole truth, the expert must point-out to the court if and how insurance companies' adverse medical evaluations were inadequate, inappropriately performed, or lacking in scientific/medical validity. Doing so does not make the clinician an advocate in court, but rather it helps the court make a decision based on sound medical principles as opposed to ignorance and/or misrepresentations.

It should be remembered that medicine is an art that uses scientific principles, but an art nonetheless. Some medical experts are more skilled than others. The clinician who specializes in pain management and has particular expertise in evaluating individuals claiming chronic painful problems post-trauma deserves to have his/her opinions regarded carefully and with

respect.

In summary, the health care professional must remember that the court needs to know *(i)* what the patient is suffering from, *(ii)* if the medical problem could have been precipitated or caused by trauma, *(iii)* if the problem was indeed precipitated or caused by the accident/incident in question *(i.e.,* if the trauma had not occurred, would the patient have this problem), *(iv)* if the problem is temporary or permanent, and *(v)* the cost of future care for the injuries sustained in the trauma. The court needs to know these things to a reasonable degree of medical probability or certainty. The physician's education, training, and experience, as well as his/her knowledge of the particular patient in question, should be the basis for giving such opinions.

Trauma can cause chronic soft tissue pain. The clinician needs to be aware of how this can occur and thus be in a position to adequately assess the patient in question, initiate proper treatment, and, if called upon, assist the court in the event that the patient is involved in litigation.

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