

Preventing Delayed-Onset Muscle Soreness: Integrating Treatments

Ronda Wimmer, PhD, MS, LAc, ATC, CSCS, CSMS, SPS

Have you ever worked out consistently and then suddenly stopped because *life happened*? Or have you ever worked long hours before a three- or four-day weekend? Whether it is from working out at the gym or putting in long hours at the office, I am sure that at some point, we have all experienced delayed muscle soreness after a demanding activity. The technical jargon for this soreness is delayed-onset muscle soreness (DOMS). Usually, within 24 to 48 hours of performing a strenuous activity, the individual is so sore that it is hard to move or function normally. When DOMS takes effect, the body will overcompensate, such as walking up and down a flight of stairs gingerly or using the entire body to reach for a piece of paper, instead of solely using the arm. Oriental medicine can, in many cases, prevent and/or lessen the soreness associated with DOMS.

Injury Mechanism

The injury mechanism involves the performance of eccentric exercises (lengthening of the contracted muscle). Muscles around a joint have agonist and antagonist movers. The agonist muscles are the muscle movements creating the contraction while shortening. The antagonist muscles are the lengthening muscles on the opposing side of the joint that allows movement of the joint to occur. Within the agonistic movers, there are concentric and eccentric movers. Concentric movers within the agonistic movement are shortened, while the lengthening phases of the agonistic movement are the eccentric movers. These movements are commonly referred to as negative contractions while producing elbow flexion or arm curls (controlling the weight from the elbow flexed position back to the extended position while moving very slowly). Other examples of eccentric loading (movements) include the downward movement of the squat and/or running or walking downhill. The soreness associated with these movements impairs activity and also can create an injury, due to potential tissue damage (muscular microtrauma).

This soreness associated with DOMS usually appears within 24 to 48 hours after exercise. It takes approximately four to five days, depending upon severity, before it is relieved. The intensity of the exercise dictates the severity of potential tissue damage. Additional variables include fatigue, muscle stiffness, velocity and angle of contraction, and deconditioned vs. conditioned state of the muscles. Basically, this type of muscle loading can damage the cell membranes, with a sudden increase in the inflammatory response.

Triggering inflammation activates prostaglandin and leukotriene synthesis. The prostaglandin E_2 is directly linked with the sensation of pain by sensitizing type III and type IV pain afferents, causing chemical stimuli. Leukotrienes increase vascular permeability and attract neutrophils to the site of damage. The associated swelling is basically the result of cells and fluids moving within the bloodstream. This contributes to the sensation of pain with associated point tenderness, usually in the belly of the affected muscle.

Physiological Manifestations and Pain Perception Associated With DOMS

Most acute and/or chronic injuries have associated symptoms such as decreased range of motion, stiffness, pain, point tenderness, decreased strength, and probable swelling. It is interesting to note that a majority of the current research indicates that the pain and stiffness associated with DOMS is actually linked to the inflammatory response, instead of tissue microtrauma. In the sports medicine arena and research literature, typical treatment protocols focus upon decreasing and/or limiting the degree of the inflammatory response.

Pain is the response of pain receptors (nociceptors) that respond to chemical and/or electrical stimuli within the muscles. During the inflammatory response, substances such as bradykinin, serotonin, histamine, prostaglandin and potassium can activate the nociceptive system. In this cascade of chemical reactions, bradykinin is significant. Typically, hyperalgesia follows after muscle injuries because nociceptive sensors transmit pain (diffuse and dull) from group IV unmyelinated afferent fibers. Bradykinin reduces the threshold of mechanoreceptors, causing pain to be produced within normal tissue pressures from normal movement, basically acting as a mediator.

Differentiating Between Pain and Soreness

We must be able to differentiate between clinical manifestations of muscle soreness, burning pain and muscles cramps in order to treat our patients as specifically and efficiently as possible.

Muscle soreness is muscle discomfort that changes with pressure and/or movement. So palpation is a significant indicator to identify the degree of muscle tenderness. Active range of motion, palpation and passive stretching usually will aggravate this condition.

"Burning" pain experienced after anaerobic exercising usually results from deficient availability of energy supplies. These metabolic processes involved produces noxious substances, such as low pH or potassium ions. The alterations in homeostasis of pH and ions in local ionic distributions stimulate free nerve endings. In healthy individuals, this burning pain typically goes away within a few minutes after stopping the activity/exercise. This is due to oxygen being able to remove the waste byproduct (lactic acid) from anaerobic contractions, thus restoring ionic gradients by the return of high-energy phosphagens.

Muscle cramps are caused by high-stimulation frequencies that create uncontrolled muscle activation to remain in contracted positions. An example of this muscle loading is using an isometric contraction (resistance at a specific angle). Throughout high-tension, isometric contractions, the blood flow to the muscles decreases because of the high compressive forces the involved muscle is generating. Thus, pain associated within the muscle is due to metabolic factors, frequently identified with ischemic conditions and fatigue associated with these exercises. The intensity of pain is equivalent to noxious stimuli concentration levels. Be aware that even though stretching the muscle may take care of the cramp, it will exacerbate DOMS.

Injury Mechanism - Eastern Perspective

Within the philosophy of Chinese medicine, the blood and *qi* become stagnant due to excessive loads from eccentric exercise. This affects the spleen's function to transform and transport, and the liver's function to spread *qi* in all directions. The severity is dependent upon the level of the athlete, along with any underlying conditions that are then exacerbated with this type of exercise. The idea is to prevent DOMS from occurring, which means one must anticipate and understand not only Oriental medicine, but also the concept of eccentric movements.

Acute injuries involve *qi* and blood and include other pre-existing conditions that involve body fluids, channels/vessels/meridians and *zang/fu* organs. The most common is blood and *qi* stagnation

that represents an excess condition. While chronic conditions have pre-existing deficiency associated with *zang/fu* organs, *qi*, blood and/or body fluids affect the channels/vessels/meridians. In both instances, the *qi* and blood flow become interrupted and can cause stagnation to occur, meaning *qi* and blood diminish and may become completely obstructed. Conversely, if there is interior deficiency, this will not only support the other *zang/fu* organs and their associated pattern functions, but also the channels/vessels/meridians.

Pain is a good indicator for a number of reasons. The location identifies the channels/vessels/meridians that are involved. The quality of pain provides information as to the severity of the patterned involvement of *zang/fu* organs, *qi*, blood and body fluids. The pain also indicates the degree of excess and/or deficiency with the associated condition. This information will help differentiate pre-existing conditions associated with pain rather than just the symptoms (physiological manifestations).

Treatment

The current, widely implemented treatment protocol for DOMS, validated through research, recommends nonsteroidal anti-inflammatory drugs (NSAIDs), such as ibuprofen, specifically to manage inflammation. However, research also indicates mixed findings, because adverse effects have been identified with drugs associated with prostaglandin synthesis - specifically the cyclo-oxygenase pathway. After tissue injury, prostaglandins involve degradation of tissues and tissue growth during the muscle repair/regeneration and remodeling phase of the injury cycle, which create catabolic actions.

Oriental medicine focuses on simultaneously treating excess conditions, such as moving the blood and *qi* to prevent stagnation from occurring, as well as supporting individualized deficient conditions that predispose an individual to other pre-existing conditions within the *zang/fu* organs, such as *qi* deficiency and stagnation, blood deficiency and stagnation, Damp Phlegm accumulation, yin and/or yang deficiency - all of which give rise to Wind, Cold, Damp bi-syndrome invasion, exacerbating the condition and invasion of the collaterals. This is all dependent upon the individualized diagnostic methodology, with a number of possible treatment combinations. In differentiating *qi* vs. blood stagnation, an easy rule applies: Pain followed by swelling *qi* stagnation is predominant; swelling followed by pain blood stagnation is more predominant. Usually, they occur together.

Acupuncture treatment primarily focuses on the combination of distal, local, adjacent points, in addition to specific pattern-associated points. Distal points, used to move stagnation, can be used on affected channels or associated channels/vessels/meridians: SI/UB, LI/ST, SJ/GB, etc. Also, the distal point can be combined with the upper and lower extremities, including wrist/ankle, elbow/knee and shoulder/hip. The adjacent and local points are identified according to the area affected. This theory is also identified with segmental acupuncture, explained within the neuron doctrine as its philosophical basis. Comparatively, this implementation of treatment protocols tends to be very limited in application because this is a sign- and symptom-based understanding and does not address pre-existing conditions, as in the TCM preventative model. However, current research in the biological sciences accepts this physiological explanation, at this point, validating the treatment of pain for acupuncture. Having said this, the importance of understanding both perspectives provides a great deal of insight, enabling the differentiation between the two.

Remember, there are many different point combinations and herbal formula combinations that can be used. Your acupuncture and herbal prescriptions are based upon your individual clinical impression/diagnosis for your patient. Below are some examples of these potential combinations that can be implemented:

- Channel/vessels/meridians distal points: LG7/LI4; HT5/SI3; SP5/ST40; LV5/GB41; P6/SJ5; K4/UB60.
- Distal points according to affected area: Spine: Cervical/neck primary points SJ5, SJ8, SI3, GB39, UB60, secondary points K4, ST40/Sacrum UB40, UB58; Fingers none/Toes LI4; Wrist GB40, ST36, SP5/Ankle none; Elbow LI1, LI4, SJ5/Knee SI5, SP5; Shoulder LI1, LI4, LG7, SJ1, SJ5, UB58, ST38/Hip UB62, GB41.
- Adjacent points according to involved area: Spine: Cervical/neck primary points Du14, GB21, UB11/Sacrum UB23; Fingers SJ5/Toes ST41, GB34, SP4; Wrist SJ6, LG7/Ankle ST36, K7GB34; Elbow LI10, LI13, LI14/Knee ST36, SP10; Shoulder SI9, SI10, SI11, SI12, SI13, SI14, SI15, LI14, GB21, SJ13, SJ15/Hip GB31.
- Local points according to involved area: Spine: Cervical/neck primary points UB10, GB20/Sacrum UB27; UB28, UB32 Fingers SJ3, LI3 Baxie/Toes SP3, Bafeng; Wrist SJ4, LI5, SI5, SI4, P7/Ankle SP5, GB40, UB60, ST41; Elbow LI11, SI8, SJ0/Knee ST36, SP9, K10, UB40, GB34, LV7, LV8, Xiyan; Shoulder SJ14, SI9, SI10, LI14, LI15, Jai-neiling/Hip GB29, GB30.
- Other points associated with pre-existing conditions, such as deficiency: K/LV points K3, LV8, ST36, SP6, R4, UB11, UB18, UB23, GB34, GB39 can be used. If qi and blood deficiency are present, then the addition of SP6, ST36 UB20, UB23, R4 and LV8 can be implemented. Excess conditions, such as blood stagnation, one can include SP6, SP10, UB17, LI11 and P6. If phlegm is present, SP9, ST40, R9 can be implemented, with tonification to UB20 and R12, rather than sedation or other methods that are typically implemented with excess conditions with phlegm cases.
- *Ah shi* point also can be used.

The use of acupuncture points, tuina, linaments, cupping, moxabustion, auricular therapy and herbal formulas are very effective, among other TCM modalities. There are a number of herbal formulas used to treat blood and qi stagnation, as well as individual pre-existing conditions. In some cases, herbal formulas used in bi-syndrome also may be effective - usually if pre-existing deficiency is present.

Summary

The focus of Oriental medicine tends to go beyond the traditional symptom-based treatment protocols into more integrated diagnostic methodologies addressing prevention. However, prevention as practiced here in the states frequently is implemented within the public health arena, with its focus primarily addressing educating the general population and/or vaccines. Using TCM, we are more specifically anticipating the physiological manifestations and preventing them before the signs and symptoms occur. Oriental medicine provides this unique ability to diagnose and treat preventatively.

DOMS is one of many examples within TCM providing preventative treatments with understanding the injury mechanism. In this case, understanding the exercise physiology of eccentric contractions enables us to treat our patients more efficiently and effectively by integrating these clinical and academic perspectives and bridging communication barriers. Increasing interprofessional dialogue establishes credibility and trust, cultivating receptive opportunities with research collaborations. From a public health standpoint, keeping patients healthy is more cost-effective in the long run as Generation X, and each generation thereafter, ages and needs medical care. The ultimate goals, as reiterated through numerous professional peer-reviewed literature, is to provide the efficient, cost-

effective, *individualized* quality of care that patients deserve and expect.

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