AN INTRODUCTION TO MYOFASCIAL ROLLING

Presented by The National Academy of Sports Medicine

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INTRODUCTION

The first phase in the Corrective Exercise Continuum is to inhibit or modulate activity of the nervous system that innervates the myofascia. One of the most common myofascial techniques used to inhibit is myofascial rolling or often called self-myofascial release (SMR). However, with the abundance of recent research, the term"release" may not be supported. Thus, using self-myofascial rolling may be more appropriate.

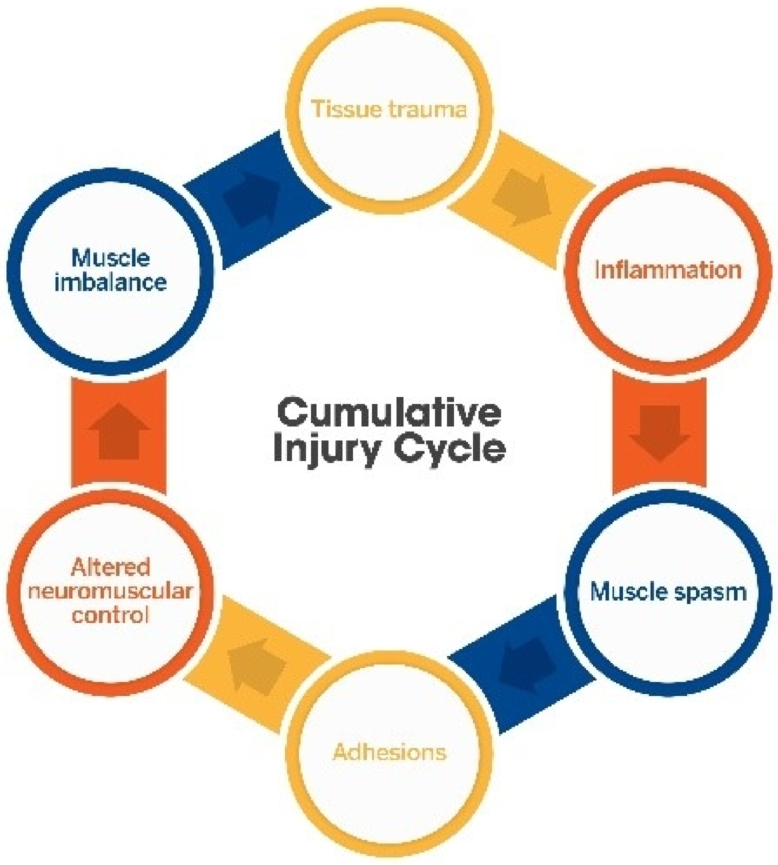
This technique uses various tools such as a foam roller, roller ball, or handheld device. Other myofascial manual techniques (myofascial massage, instrument-assisted soft-tissue mobilization, joint mobilization, and so forth) may be used by allied health professionals to address the myofascia.

During the past decade the use of myofascial rolling techniques (i.e., foam-rolling muscles) has emerged to become a relatively common and practical intervention used within the health and fitness environment

The body of research has grown over the past 5-years which has focused on the therapeutic and physiological effects of the intervention. The following sections will review the current research and discuss the NASM position on myofascial rolling.

THE CUMULATIVE INJURY CYCLE

It is essential for the health and fitness professional to understand that poor posture and repetitive movements can create dysfunction within the connective tissue of the human movement system (Iqbal & Alghadir, 2017). These dysfunctions eventually lead to an injury and repair response by the body termed the cumulative injury cycle (Figure 3.3) (Clark et al., 2010; Iqbal & Alghadir, 2017).



Current theory supports the idea that repetitive movements, such as those experienced by baseball pitcher, or a repetitive lack of movement, such as long-periods of poor posture (e.g. upper cross syndrome), are believed to lead to tissue trauma and inflammation. Inflammation in turn activates the body's pain response, which initiates a protective mechanism, increasing muscle tension and causing muscle spasm.

These muscle spasms are not like a calf cramp. Heightened activity of the central nervous system (CNS) and tissue mechanoreceptors and nociceptors (e.g. pain receptors) in the injured area create, in essence, a type of microspasm or "tension" (Jafri, 2014). As a result of the spasm, adhesions may begin to form within the myofascial tissues. These adhesions form a weak, inelastic matrix that decreases normal mobility of the soft tissue (Clark et al., 2010; Money, 2017) (Figure 3.4).

Myofascial rolling and static stretching, as described in the NASM-CES text, may help to reset the Cumulative Injury Cycle by modulating the local receptor activity, tension (microspasm), and CNS activity that develop from the traumatized tissue.

Furthermore, researchers and experts have postulated that myofascial rolling may help "break up" the fascial adhesions or "trigger points" that are created through the cumulative injury cycle process (Behm & Wilke, 2019).

However, current research doesn't fully support these theories but does suggest that post-myofascial improvements may be from local mechanical and neurophysiological mechanisms (Behm & Wilke, 2019). These theories will be discussed in the subsequent sections.

MYOFASCIAL ADHESIONS, DAVIS'S LAW & RELATIVE FLEXIBILITY

Myofascial Adhesions

Myofascial adhesions disrupt normal tissue mobility resulting in altered length-tension relationships, force-couple relationships and neuromuscular control, which can result in altered joint movement. (Jafri, 2014; Zhuang et al., 2014). If left unchecked, these adhesions may begin to form structural changes in the soft tissue that are evident by Davis's law.

Davis's Law

Davis's law states that soft tissue will model along the lines of stress (Cyron & Humphrey, 2017; Mueller & Maluf, 2002). Soft tissue remodels or rebuilds itself with a collagen matrix that forms in a random fashion and not in the same direction as the muscle fibers.

If the myofascia is not stimulated by movement, lengthening, and broadening these connective tissue fibers may act as a roadblock, preventing soft-tissue mobility. This creates alterations in normal tissue mobility and causes relative flexibility (Clark et al., 2010; Iqbal & Alghadir, 2017).

Relative Flexibility

Relative flexibility is the phenomenon of the human movement system seeking the path of least resistance during functional movement patterns (or movement compensation) (Clark et al., 2010). Continued movement compensation can lead to further muscle imbalances and potential injury.

THE LOCAL MECHANICAL EFFECT

Local Mechanical Effects

Thixotropy, reduces myofascial restriction through reduced visco-elasticity, fluid changes, cellular responses, reduced local arterial tissue perfusion, and improves vascular endothelial function.

Global Neurophysiological Effects

Tissue relaxation: CNS afferent input from the Golgi tendon reflex, gamma loop modulation, and mechanoreceptors.

Pain: Cutaneous receptors (e.g. interstitial type III and IV, free nerve endings, C-tactile fibers) , mechanoreceptors , afferent central nociceptive pathways (gate theory of pain), descending anti-nociceptive pathways (diffuse noxious inhibitory control), decreases evoked pain, and reduces spinal-level excitability.

For the local mechanical effect, the direct roller pressure may change the viscoelastic properties of the local myofascia by mechanisms such as thixotropy (reduced viscosity), reducing myofascial restriction, fluid changes (fascial hydration), and cellular responses (Behm & Wilke, 2019; Jay et al., 2014; Kelly & Beardsley, 2016).

For example, an individual with limited ankle ROM, could implement a myofascial rolling protocol for their calves. When considering the local mechanical effects, the individual may experience an immediate improvement in ROM as the mechanical pressure improves fluid movement, blood flow, and reduces myofascial adhesions.".

Researchers have also found that rolling reduces local arterial stiffness (Okamoto et al., 2014), increases arterial tissue perfusion (Hotfiel et al., 2017), and improves vascular endothelial function (Okamoto et al., 2014), which are all related to local physiological changes.

GLOBAL NEUROPHYSIOLOGICAL EFFECTS

For the neurophysiological effect, the direct roller pressure may influence tissue relaxation and pain in the local and surrounding tissues. For tissue relaxation, the roller pressure may induce a greater myofascial relaxation or "stretch tolerance" through CNS afferent input from the Golgi tendon reflex, gamma loop modulation, and mechanoreceptors (Aboodarda et al., 2015; Behm & Wilke, 2019; Cavanaugh et al., 2017; Cheatham & Kolber, 2017; Jay et al., 2014; Kelly & Beardsley, 2016; Monteiro et al., 2017; Nagi et al., 2011).

For example, the regular use of myofascial rolling may help down regulate the bodies protective mechanisms that limited full extensibility. With this influence on stretch tolerance, a muscle will be able to be stretched further and held for longer, leading to quicker changes overall

FOAM ROLLING AND PAIN

For pain, researchers have postulated that roller pressure may modulate pain through stimulation of muscle and cutaneous receptors (e.g. interstitial type III and IV, free nerve endings, C-tactile fibers) (Aboodarda et al., 2015; Behm & Wilke, 2019; Nagi & Mahns, 2013; Nagi et al., 2011), mechanoreceptors (Young et al., 2018), afferent central nociceptive pathways (gate theory of pain), (Aboodarda et al., 2015; Cavanaugh et al., 2017), and descending anti-nociceptive pathways (diffuse noxious inhibitory control) (Aboodarda et al., 2015; Sullivan et al., 2013).

Researchers have found that myofascial rolling decreases evoked pain (Cavanaugh et al., 2017) and reduces spinal-level excitability (Hoffman reflex) (Young et al., 2018), which provides evidence for these theories. These responses may be triggered by low, moderate, or high roller pressure lending evidence to the sensitivity of the myofascia to external forces (Grabow et al., 2018).

For example, pressure from the roller may lead to an immediate, yet temporary reduction in discomfort. While myofascial rolling should never be used as a tool to treat an injury or pain, the reduction of discomfort may help to provide a window opportunity in which better movement patterns may be introduced (i.e., Corrective Exercise Program). Over time, the improved movement patterns may have a longer lasting positive effect.

CLOSING THOUGHTS

Self-myofascial rolling is an excellent technique used to inhibit overactive muscles and improve mobility of the myofascial tissues having a positive impact on the Cumulative Injury Cycle. While research is still emerging, leading theories suggest that the self-myofascial rolling has an overall effect on the CNS and a local mechanical effect on the tissues being rolled. When used in conjunction with a systematic assessment process and other modalities, such as static stretching, foam rolling can be used to improve joint range-of-motion and restore optimal movement patterns.

REFERENCES

Aboodarda, S. J., Spence, A. J., & Button, D. C. (2015). Pain pressure threshold of a muscle tender spot increases following local and non-local rolling massage. BMC Musculoskelet Disord, 16, 265. http://doi.org/10.1186/s12891-015-0729-5

Behm, D. G., & Wilke, J. (2019). Do self-myofascial release devices release myofascia? Rolling mechanisms: A narrative review. Sports Med. http://doi.org/10.1007/s40279-019-01149-y

Cavanaugh, M. T., Doweling, A., Young, J. D., Quigley, P. J., Hodgson, D. D., Whitten, J. H., Reid, J.C., Aboodarda, S.J., & Behm, D. G. (2017). An acute session of roller massage prolongs voluntary torque development and diminishes evoked pain. Eur J Appl Physiol, 117(1), 109-117. http://doi.org/10.1007/s00421-016-3503-y

Cheatham, S. W., & Kolber, M. J. (2017). Does self-myofascial release with a foam roll change pressure pain threshold of the ipsilateral lower extremity antagonist and contralateral muscle groups? An exploratory study. J Sport Rehabil, 1-18. http://doi.org/ 10.1123/jsr.2016-0196

Clark, M., Lucett, S., & Medicine, N. A. S. (2010). NASM Essentials of Corrective Exercise Training. Lippincott Williams & Wilkins.

Cyron, C. J., & Humphrey, J. D. (2017). Growth and remodeling of load-bearing biological soft tissues. Meccanica, 52(3), 645-664. http://doi.org/10.1007/s11012-016-0472-5

Hotfiel, T., Swoboda, B., Krinner, S., Grim, C., Engelhardt, M., Uder, M., & Heiss, R. U. (2017). Acute effects of lateral thigh foam rolling on arterial tissue perfusion determined by spectral doppler and power doppler ultrasound. J Strength Cond Res, 31(4), 893-900. http://doi.org/ 10.1519/jsc.0000000000001641

Iqbal, Z. A., & Alghadir, A. H. (2017). Cumulative trauma disorders: A review. J Back Musculoskelet Rehabil, 30(4), 663-666. http://doi.org/ 10.3233/bmr-150266

Jafri, M. S. (2014). Mechanisms of myofascial pain. Int Sch Res Notices, 2014. http://doi.org /10.1155/2014/523924

Jay, K., Sundstrup, E., Sondergaard, S. D., Behm, D., Brandt, M., Saervoll, C. A., Jakobsen, M.D., & Andersen, L. L. (2014). Specific and cross over effects of massage for muscle soreness: Randomized controlled trial. Int J Sports Phys Ther, 9(1), 82-91. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3924612/

Kelly, S., & Beardsley, C. (2016). Specific and cross-over effects of foam rolling on ankle dorsiflexion range of motion. Int J Sports Phys Ther, 11(4), 544-551. https://www.ncbi.nlm.nih.gov/pubmed/24567859

Money, S. (2017). Pathophysiology of trigger points in myofascial pain syndrome. Journal of Pain & Palliative Care Pharmacotherapy, 31(2), 158-159. http://doi.org/10.1080/15360288.2017.1298688

Monteiro, E. R., Škarabot, J., Vigotsky, A. D., Brown, A. F., Gomes, T. M., & Novaes, J. da S. (2017). Acute effects of different self-massage volumes on the FMS TM overhead deep squat performance. International Journal of Sports Physical Therapy, 12(1), 94–104. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5294950/

Monteiro, E. R., Škarabot, J., Vigotsky, A. D., Brown, A. F., Gomes, T. M., & Novaes, J. da S. (2017). Acute effects of different self-massage volumes on the FMS TM overhead deep squat performance. International Journal of Sports Physical Therapy, 12(1), 94–104. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5294950/

Mueller, M. J., & Maluf, K. S. (2002). Tissue adaptation to physical stress: A proposed "physical stress theory" to guide physical therapist practice, education, and research. Physical Therapy, 82(4), 383-403. http://doi.org/10.1093/ptj/82.4.383

Nagi, S. S., & Mahns, D. A. (2013). C-tactile fibers contribute to cutaneous allodynia after eccentric exercise. J Pain, 14(5), 538-548. http://doi.org/10.1016/j.jpain.2013.01.009

Nagi, S. S., Rubin, T. K., Chelvanayagam, D. K., Macefield, V. G., & Mahns, D. A. (2011). Allodynia mediated by C-tactile afferents in human hairy skin. J Physiol, 589(Pt 16), 4065-4075. http://doi.org/10.1113/jphysiol.2011.211326

Okamoto, T., Masuhara, M., & Ikuta, K. (2014). Acute effects of self-myofascial release using a foam roller on arterial function. J Strength Cond Res, 28(1), 69-73. http://doi.org/10.1519/JSC.0b013e31829480f5

Sullivan, K. M., Silvey, D. B. J., Button, D. C., & Behm, D. G. (2013). Roller-massager application to the hamstrings increases sit-and-reach range of motion within five to ten seconds without performance impairments. International Journal of Sports Physical Therapy, 8(3), 228–236. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3679629/

Young, J. D., Spence, A. J., & Behm, D. G. (2018). Roller massage decreases spinal excitability to the soleus. J Appl Physiol, 124(4), 950-959. http://doi.org/10.1152/japplphysiol.00732.2017

Zhuang, X., Tan, S., & Huang, Q. (2014). Understanding of myofascial trigger points. Chin Med J (Engl), 127(24), 4271-4277. http://doi.org/10.3760/cma.j.issn.0366-6999.20141999