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Ligament and Muscle Stress

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Muscles and ligaments are normally exposed to stress throughout life. Their structures are such that they respond and adapt to the usual amount of stress exposure. Damage occurs when the muscle or connective tissue is exposed to higher-than-usual stress levels. This can be a single, sudden excessive stress, or the result of repetitive stress to the muscle or ligament. In either case, the doctor of chiropractic must determine how the damage occurred, and then make appropriate recommendations to help the body heal the injury and to prevent a recurrence.

Problems can also develop when these tissues are not exposed to sufficient regular stress to maintain functional health. It's important to recognize that there is a "continuum," or spectrum of usual stress to the tissues in the body, and that categorizing a patient's level of use helps in the planning of treatment and exercise regimens.

The Continuum of Use

What we usually consider to be normal use is in the mid-range of the use continuum. At one far end is *paralysis*, when the skeletal muscles and ligaments are completely unused. Close to paralysis is *immobilization*, such as in a cast or with bedrest. The difference between these is that paralysis lacks a neurological stimulus, called "tone," which is present in immobilized (yet still neurologically intact) muscles and skeletal ligaments.¹ Next is *sedentarism*, when the ligaments and muscles are used only minimally. Unfortunately, this condition is becoming more common for all age groups in our technologically enriched society, which has so many labor-saving devices. *Normal use* can vary widely, but requires the intermittent and regular exercise and use of all muscles and ligaments. Those who are employed in active (usually blue-collar) jobs and people who engage in regular, active recreational pursuits, fall into the *strenuous* use category. And then there are the athletes, who are always trying to improve and push their limits by specifically building and strengthening their muscular and skeletal ligament tissues. They are at the far end

of the continuum, demonstrating the body's response to *progressive overload*.

Paralysis - When the muscles and ligaments are not used at all, their functional properties rapidly diminish. The combination of muscle atrophy and ligament stiffening produces joints that do not function smoothly or easily. In some cases, the complete lack of use causes calcium to infiltrate into the soft tissues, resulting in heterotopic ossification.²

Immobilization - When a joint or extremity has been immobilized, atrophy sets in rapidly. The muscles shrink and the ligaments get stiffer and weaker. In fact, within a month, an immobilized muscle will lose up to one half its normal size.³ After just one week of immobilization, a 20-percent decline in muscle strength has been measured!⁴ Ligaments which have been immobilized for two months have been found to have only about half of their functional strength and resistance to stretch and injury.⁵

Sedentarism - In today's society, we are able to avoid most physical efforts that were previously necessary to put food on the table and keep our homes warm. Most of our patients no longer have to perform any significant physical labor. The result is several problems: obesity', deconditioning', hypertension', and poor fitness in general. One in three Americans is clinically obese (defined as 20 percent or more above normal weight), and more than half are overweight.⁶ This new reality causes problems for doctors of chiropractic that attempt to return patients to all capabilities; they find that many of their patients are too out of shape to maintain normal spinal function. Among other terms, this condition has very appropriately been called the "disuse syndrome."⁷

Normal Use - Throughout most of our existence, humans have needed to perform a variety of daily physical activities. Some strength was needed, as was a certain amount of flexibility and endurance. This began to change when the Industrial Revolution required certain repetitive movements, and now has been modified by our labor-saving inventions over the past century.

Strenuous Use - By exercising regularly and participating in recreational sports, some of our patients train their ligaments and muscles harder than most. Some occupations place more than the usual stress on the feet, legs, and spine of some patients. This is beneficial, so long as the use does not exceed the body's response to the stress. However, these are the patients who are susceptible to repetitive injuries, due to ongoing, stressful use that eventually overcomes the ability to strengthen muscle and ligaments.

Progressive Overload - Athletes who push their bodies to continuously improve their performance take advantage of our innate ability to respond to stress by building strength. In response to gradually increasing loads, the muscles and ligaments strengthen and improve their function.⁸ Many factors must be considered when designing and implementing these types of programs, so that injury can be avoided.⁹

Overuse and Damage

The muscles and ligaments in any of the above categories can be overused and damaged. Less stress is needed to cause injury to tissues in the lower use end of the continuum. After several days of immobilization, or when someone has been on bed rest or is a "couch potato," even mildly strenuous effort can be too much. Fitness protects from some injuries, especially overuse conditions of the spine. Athletes who are regularly pushing their muscles and ligaments are most likely to end up with either overuse or acute injuries. There are two major categories of excessive stress to ligaments and muscles - repetitive use (chronic, over time), and sudden injury (strain or sprain) with tissue tearing.

Repetitive overwhelm - As discussed above, when the muscles and ligaments are stressed, they respond by repairing and strengthening. In some cases, however, the physical stress occurs so frequently that this process is overcome, resulting in damage. Examples include: runners who quickly increase their mileage, workers who are placed in a new position requiring repetitive movement or bending, and athletes who practice throwing to the point that they injure their shoulders. Even someone taking up walking after years of standing on rigid flooring can quickly overwhelm the foot's ability to strengthen, developing plastic deformation of the *plantar fascia* with arch collapse.

Acute injury - Of course, trauma to a ligament or muscle is a single episode of stress that causes damage. When a muscle or ligament is torn, there is immediate pain, followed by swelling and loss of function. Around the spine, this is often a complex injury, since it is inevitable that several layers of both muscles and connective tissues will have been damaged (a "strain/sprain" injury). Understanding of the healing response is necessary for good management of acute injuries to muscles and ligaments, wherever their locations.

Healing Response

Whether damaged by repetitive overuse or by acute injury, muscles and ligaments will heal most rapidly and completely when they are treated properly. A brief period of "relative rest" is important; the rest period depends on the extent of injury. This may require one to four days of immobilization of the damaged region,

followed by gradual reintroduction of movement and activity.¹⁰ Reactivation is also necessary; this usually requires specific exercise instruction and expert guidance. The patient should be encouraged to return to the level of pre-injury, and then be advised on preventing further injury, either by providing additional response time or by improving muscle strength and balance (or both). Occasionally, ligaments become damaged and deformed to the point that full repair is not possible. In these cases, modification of stress may be necessary, either through changes in activities or through the use of supports, such as knee braces or custom foot orthotics.

Conclusion

It is vitally important to understand the status of a patient's muscle and ligament tissues prior to injury. It's also important to realize how these tissues became overwhelmed: Was it an acute injury, or can a history of repetitive insult be elicited? Once the doctor of chiropractic has the information for the "start point," and an understanding of the method of stress damage, the treatment can proceed rapidly. This is what separates caring doctors of chiropractic from those providers who prescribe drugs or bedrest for ligament and muscle injuries.

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