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Article #6 (1.5 contact hours)

Refereed Peer Review

Massage Therapy in Horses: Assessing Its Effectiveness from Empirical Data in Humans and Animals

KEY FACTS

- According to empirical data in humans:
 - Massage does not appear to affect blood circulation to muscles.
 - Lactic-acid accumulation does not cause muscle soreness.
 - Massage has not been shown to aid athletic performance.
- According to empirical data in rodents, massage may be able to induce fibroblast proliferation in healing tendons.

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ABSTRACT: Massage is a relaxing and enjoyable diversion for some people. A more recent derivation, massage therapy, has been claimed to have many therapeutic benefits and has been advocated for treating a variety of musculoskeletal problems in animals. Few of those treatment claims are supported by scientific data.

Interest in massage therapy for animals appears to be increasing in recent years. Therapeutic massage is practiced on horses,¹ small animals,² and, of course, human athletes.³ Its reputed therapeutic benefits include quicker recovery following intense exercise, enhanced healing of musculoskeletal injuries, reduction of muscle soreness and swelling, attenuation of the postexercise inflammatory response, and promotion of muscle relaxation.³⁻⁵ Despite these and other claims related to the potential for massage to enhance aspects of physical work performance and the widespread use of massage on humans and horses, relatively little data have been gathered to support or refute claims related to its efficacy.³⁻⁵ Hence the question: What do studies in animals and humans say about the claims made by animal massage therapists regarding the value of massage for animals? This article reviews the history of massage therapy, some of its claimed benefits, its suggested mechanisms related to muscle healing and recovery from muscular work, and the current scientific data to support or refute these claims (Table 1).

HISTORY

The laying on of hands in an effort to stimulate and promote healing is one of

Table 1. Scientific Data on the Reputed Benefits of Massage Therapy

<i>Claimed Benefit</i>	<i>Supported</i>	<i>Refuted</i>	<i>Sources</i>
Improved muscle blood flow		X	Cafarelli et al, ³ Tiidus, ⁶ Shoemaker et al, ¹¹ Tiidus et al ¹²
Decreased postexercise muscle inflammation		X	Tiidus, ⁶ Tiidus et al ¹²
Reduced finger edema	X		Flowers ²⁰
Improved lymphatic flow		X	Callaghan, ⁵ Elkins et al ²¹
Improved muscle strength		X	Shoemaker et al ¹¹
Toxin removal		X	Clarkson et al, ⁷ Smith, ⁸ Hemmings et al, ²⁶ Armstrong, ²⁴ Armstrong et al, ²⁵ Gupta et al ²⁷
Eliminated muscle “knots” and pain		X	Gam et al ³²
Long-term relief of delayed-onset muscle soreness		X	Cafarelli et al, ³ Tiidus, ⁶ Shoemaker et al, ¹¹ Tiidus et al ¹²
Improved muscle recovery and performance		X	Cafarelli et al, ³ Tiidus, ⁴ Callaghan, ⁵ Hemmings et al, ²⁶ Drews et al ³⁴
Augmented tendon healing	X		Gehlsen et al, ³⁵ Davidson et al ³⁶
Reduced scar tissue		X	Patino et al ³⁹
Relief from postburn pain and itching	X		Field et al ³⁸
Psychologic improvement, relaxation, and mood enhancement	X		Hemmings et al, ²⁶ Vickers, ²⁸ Weinberg et al ⁴⁰

the oldest known healing practices. It is described in the healing traditions of many diverse cultures, including one of the oldest surviving medical works, the Chinese *Huangdi Neijing*, as well as ancient Indian and Greek texts. The practice was later widely employed in the Roman Empire, but the decadence associated with that period tarnished the reputation of massage for more than 1000 years.

Following the return of French colonists from India in 1779, the practice was revived in Europe. The word *massage* appears to be originally derived from the Arabic word *massa*, meaning to touch or feel. The modern practice of massage dates to the 1863 publication of the French work *Du Massage*, which classified various massage techniques according to which body system was purportedly affected by them. This classification system subsequently sparked the development of contemporary massage techniques.¹ On its most fundamental level, massage is the application of pressure to muscles, joints, and tendons with the hands; however, many methods of application have been described, including the use of mechanical vibrating devices.

POSTEXERCISE MUSCLE HEALING

Massage therapy has been reputed to influence muscle

healing following exercise. If massage is able to influence postexercise muscle damage or repair, it should do so by moderating one or more factors associated with physiologic muscle damage/repair processes.⁶ Indices of exercise-induced muscle damage and repair include muscle swelling, sarcolemma and other membrane disruption, enzyme leakage, ultrastructural damage, neutrophil and macrophage infiltration, and satellite-cell activation.^{7,8} Other muscle-damage indices include disruption to the cytoskeleton, disruption to the z-disk proteins (e.g., dystrophin, titin, desmin, α -actinin), and the loss of membrane glycoproteins (e.g., fibronectins).^{9,10}

Physical signs associated with muscle damage repair include delayed-onset muscle soreness, prolonged muscle weakness, and muscle stiffness.^{3,4,8} The effects of massage on most of these processes and signs of muscle damage and repair have not been extensively researched and, for most of these processes and signs, there are virtually no data available directly demonstrating the influence of massage.⁶ However, a few areas related to muscle damage and repair have received some research attention.

IMPROVING MUSCLE BLOOD FLOW

It has been claimed that massage therapy may be able to enhance muscle healing by increasing muscle blood

flow, thereby making oxygen, nutrients, and blood-borne factors (e.g., neutrophils, macrophages) more accessible to damaged tissue.¹¹⁻¹³ About a dozen studies have attempted to ascertain the potential for massage to influence limb or muscle blood flow.^{3,4,11,12,14} The results of such studies have been variable. However, the majority of findings (including recent studies involving Doppler ultrasound-determined arterial and venous blood flow) have failed to support any increment in muscle blood flow induced by any type of massage in large or small muscle groups in humans.^{3,6,11,12}

Any type of pressure to tissue, including massage, may result in partial or full occlusion of blood flow. When the pressure is removed, blood flow (including retrograde flow) will temporarily increase in response to metabolic demands and to make up for the previously diminished flow. However, this does not add to the total flow distributed to muscle over a period of time.¹¹

From a physiologic standpoint, why *would* massage be expected to affect muscle blood flow? The blood supply to each tissue is precisely controlled, with each tissue receiving blood according to its metabolic needs.¹⁴ However, an increase can easily be achieved by exercise, which increases the nutrient requirements of muscles and can increase blood flow to muscles by 20 to 30 times resting levels in humans.¹⁵ No related studies in animals appear to exist. However, even if massage affected muscle blood flow in smaller species, such an effect would most likely be attenuated in large species such as horses.

DECREASING POSTEXERCISE MUSCLE INFLAMMATION

Postexercise muscle inflammatory response and neutrophil/macrophage invasion of muscle are essential to subsequent muscle healing.^{8,16,17} Inhibition of this process leads to lack of muscle recovery, while overstimulation of these processes potentially leads to inflammation-related tissue damage.¹⁶⁻¹⁹ Very few studies have attempted to examine the potential for massage to affect postexercise muscle inflammatory responses.¹² Those that have been conducted have used indirect measurement methods and have found little evidence that massage has any substantial effect on postexercise muscle inflammatory processes.^{6,12}

IMPROVING LYMPHATIC FLOW

Muscle swelling or edema is also characteristic of postdamage muscle inflammation. Theoretically, massage may be able to enhance lymphatic flow and thus potentially reduce muscle damage-induced edema.⁵ Because of measurement difficulties, however, this possibility has never been directly measured.

Some evidence exists regarding the ability of massage to influence skin lymphatic flow. Findings suggest that massage is able to reduce finger edema in humans.²⁰ The effect was additive when combined with string wrapping to reduce edema. While the exact location of the edema was not specified, in fingers it is likely to be quite superficial (probably subcutaneous).²⁰ However, an early study using anesthetized dogs with artificially induced muscle edema reported that massage was no more effective than passive limb movement in stimulating muscle lymphatic flow.^{5,21} Thus while massage could potentially influence lymphatic drainage in superficial tissues, evidence for this effect throughout the body is currently lacking.

IMPROVING MUSCLE STRENGTH

A ubiquitous characteristic of exercise-damaged muscle is a prolonged (4 to 10 days or longer), depressed ability to generate force.^{7,22,23} This is likely due to exercise-induced structural disruption of sarcomeres, which are able to recover their integrity during the repair process.²⁴ Recovery of muscle force following exercise-induced damage is thought to be a very sensitive and noninvasive measure of muscle recovery.²³ One study directly examined the potential for daily massage treatments to influence posteccentric exercise return of voluntary static or dynamic muscle force over 4 days.¹¹ It was unable to demonstrate any positive effect of massage therapy on these parameters as measured by isometric (0°/second) and dynamic (60°/second and 180°/second) peak quadriceps muscle torques using a dynamometer.¹¹

REMOVING "TOXINS"

It has been claimed that the ability of massage to remove muscle "toxins" (i.e., lactic acid, blood lactate) benefits the healing of muscle damage and delayed-onset muscle soreness.^{6,24,25} It has been well established that lactic acid does not cause delayed-onset muscle soreness^{8,24} and has no influence on exercise-induced muscle damage.^{7,8,24,25} Hence the suggestion that massage benefits "toxin" removal can be dismissed outright. In addition, human studies have demonstrated that massage has no influence on postexercise clearance of blood lactate.^{26,27} Because massage has little influence on muscle blood flow (as previously mentioned), this finding is not surprising. However, mild exercise can significantly speed up the removal of blood lactate in humans.^{12,27}

ELIMINATING MUSCLE STIFFNESS AND SORENESS

It has often been suggested that massage can elimi-

nate muscle stiffness and “knots” and induce muscle relaxation.^{3,28} While there is significant anecdotal evidence for such potential benefits, empirical evidence for this is scarce and difficult to measure. Some evidence for reduced sympathetic activity after massage is available,⁵ and two studies have suggested a reduced H-reflex response (a measure of muscle tone) in calf muscle during, but not immediately following, massage.^{29,30} Another study³¹ reported that massage temporarily reduced electromyographic activity in back muscles of healthy volunteers. In contrast, 6 weeks of massage and exercise therapy had only minor effects on myofascial trigger points (a controversial concept developed in the 1950s; usually defined as localized areas of muscle or connective tissue that are firmer than normal tissue) in subjects experiencing chronic muscle pain. A similar lack of effect was seen in patients treated for muscle “knots” or neck and shoulder pain.³² In general, evidence for a long-term, massage-induced muscle relaxation effect is scant and inconclusive.

Postexercise muscle soreness is thought to be related to muscle inflammation and repair processes.^{8,25} If massage were capable of influencing muscle repair, inflammation, and related events such as edema, it could conceivably influence soreness sensation.⁶ However, several recent studies have found little consistent or lasting effect of massage on delayed-onset muscle soreness.^{3,6,11,12} This evidence suggests that massage, at best, may only temporarily relieve exercise-induced muscle pain and stiffness and, at worst, has no noticeable effect.

IMPROVING MUSCLE RECOVERY AND PERFORMANCE

Several studies have looked at the potential for massage to influence exercise performance and recovery from exercise-induced muscle fatigue. Although there is some conflicting evidence, the majority of these studies have found little or no evidence for any beneficial effect of massage treatment either before exercise in enhancing subsequent performance or immediately after exercise in aiding recovery from exercise-induced fatigue.^{3-5,33} Studies using elite cyclists³⁴ and boxers²⁶ have also not substantiated postexercise massage as an aid to rapid recovery of muscle function from exercise-induced fatigue in sports.

ENHANCING TENDON HEALING

In contrast to the data just discussed, two studies using rodent models have reported that augmented soft-tissue mobilization and cross-fiber friction massage pressure have induced increased fibroblast activity in injured tendons.^{35,36} Because fibroblast activation and proliferation are essential in tendon healing, these find-

ings raise some hope that massage may be able to improve the rate or quality of healing in damaged tendons and reduce the signs of tendinitis. Further studies need to be performed using actual clinical settings to validate the preliminary positive effects of massage treatment on recovery from tendon injury.

REDUCING SCAR TISSUE

Although massage may be advocated in postsurgical settings to reduce scar-tissue formation, it appears that this has not been investigated. In humans, massage has been advocated for preventing and managing postburn scars,³⁷ may help relieve postburn itching and pain, and may reduce psychologic symptoms.³⁸ However, friction massage has failed to demonstrate any appreciable effects of massage therapy on the vascularity, pliability, and height of hypertrophic scars.³⁹ Claims that massage can remove scar tissue and adhesions from any tissue are not currently supported by scientific evidence.

PREVENTING INJURY

Claims that massage can help prevent injury are not supported by scientific evidence. While no mechanism by which massage could prevent injuries is immediately apparent, if massage relaxed muscles, perhaps it could help reduce the likelihood of further injuries. However, this supposition cannot be supported based on current knowledge.

PSYCHOLOGIC BENEFITS

Several studies have reported significant psychologic, relaxational, or mood-enhancing benefits of massage to athletes.^{26,28,40} While not all studies have reported psychologic or mood-related effects of massage,³¹ these benefits are potentially of significant importance to human athletes.²⁶ Such benefits appear to be psychologic rather than physiologic; one study (albeit with a limited subject pool) found no effect of massage on circulating levels of the potential analgesic hormone β -endorphin.⁴¹

Whether such effects occur or are of any benefit in an animal model cannot yet be determined. Despite such lack of evidence, massage appears to have found some use; in one survey, 19% of participating small animal hospitals reported clients using massage on their animals.⁴² Owner-applied massage might conceivably enhance the human-animal bond at a relatively low cost and risk with concomitant psychologic benefits for the owner.

DISCUSSION

It is obvious that much more research is needed to establish the true efficacy of massage therapy in influ-

encing muscle repair and recovery from exercise. The limited amount of evidence currently available does not support the use of massage as an important therapeutic intervention in repairing muscle damage, long-term muscle relaxation, or preparing for or recovering from exercise. However, recent studies using rodent models have shown promise for a positive effect of massage on enhancing healing of tendon-based injuries. There are also potential mood-enhancing benefits of massage that need further experimental validation.

Lack of conclusive evidence for the beneficial effects of massage regarding muscle repair and comfort does not necessarily mean that massage is totally ineffective. Nevertheless, claims for the efficacy of massage therapy must currently be viewed with caution until more data become available. Using massage therapy for postexercise muscular recovery or pre-event preparation in animals is not currently supported by scientific evidence.

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ARTICLE #6 CE TEST

The article you have read qualifies for 1.5 contact hours of Continuing Education Credit from the Auburn University College of Veterinary Medicine. Choose the best answer to each of the following questions; then mark your answers on the postage-paid envelope inserted in *Compendium*.

1. Which of the following reputed benefits of massage can be supported by good evidence?
 - a. quicker recovery following intense exercise
 - b. enhanced healing of muscles following exercise-induced muscle damage
 - c. attenuation of postexercise inflammatory response and promotion of muscle relaxation
 - d. none of the above
2. Which of the following is not associated with exercise-induced muscle damage and repair?
 - a. muscle swelling
 - b. sarcolemma and other membrane disruption
 - c. lactic-acid accumulation
 - d. neutrophil and macrophage infiltration
3. Studies on massage and its influence on limb or muscle blood flow
 - a. have not been conducted.
 - b. show that the real effects are due to a rebound hyperemia.
 - c. fail to demonstrate any significant effect.
 - d. show that massage can elevate blood flow to rates similar to those seen with exercise.
4. Postexercise muscle inflammatory response and neutrophil/macrophage invasion of muscle
 - a. are essential to subsequent muscle healing.
 - b. should be inhibited by proper application of massage techniques.
 - c. are increased by some massage techniques.
 - d. ultimately lead to lack of muscle recovery.
5. Muscle swelling or edema is
 - a. related to skin lymphatic flow.
 - b. characteristic of postdamage muscle inflammation.
 - c. more effectively removed by massage than by passive limb movement.
 - d. proportional to the duration and intensity of massage maneuvers.
6. Lactic acid
 - a. buildup results in delayed-onset muscle soreness.
 - b. level is directly proportional to exercise-induced muscle damage.
 - c. is effectively cleared by proper application of massage techniques in humans.
 - d. is most effectively removed by mild exercise.
7. Research suggests that the effects of massage on muscle relaxation are
 - a. temporary at best.
 - b. due to elimination of muscle “knots.”
 - c. due to removal of accumulated “toxins.”
 - d. responsible for the elimination of delayed-onset muscle soreness.
8. Studies evaluating the potential for massage to influence exercise performance and recovery from exercise-induced muscle fatigue have
 - a. not been conducted.
 - b. generally found little or no evidence for any beneficial effect.
 - c. found that it aids recovery from exercise-induced fatigue.
 - d. found that it helps restore muscle strength.
9. An influence of massage on healing tendons
 - a. may be a result of massage-induced fibroblast proliferation.
 - b. needs to be substantiated clinically.
 - c. is not related to removal of tendon scar tissue.
 - d. all of the above
10. The limited amount of evidence currently available most strongly supports the use of massage
 - a. as an important therapeutic intervention for repairing muscle damage.
 - b. for long-term muscle relaxation.
 - c. for preparing for, or recovering from, exercise.
 - d. for its psychological benefits.