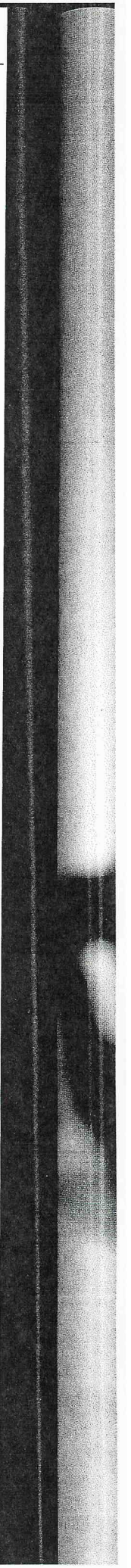
The Effects Of SPORTS MASSAGE On Athletic Performance And General Function

This study used horses as subjects to demonstrate the use of three techniques to increase range of motion in humans.

By Jo-Ann Wilson



PHOTOGRAPH BY SPENCER ROWELL

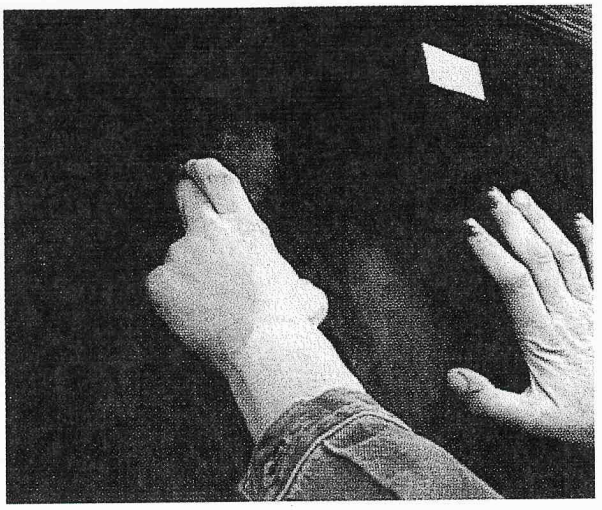
Since the late 1950s, Jack Meagher, a pioneer in the field of massage therapy, has worked with athletes. As a result of his early work, he coined the term "sports massage." Under its umbrella, he used specific techniques of direct pressure, cross-fiber friction and compressions. Despite many testimonials regarding Meagher's work, the medical profession, including physicians, physical therapists and coaches, thought massage was psychological, and athletes performed better because they believed they would do better.[1] Even today, questions about the legitimacy of sports massage exist.

Therefore, in 1999, the Jack Meagher Institute was awarded a research grant from the American Massage Therapy Association (AMTA) Foundation to scientifically determine if there was an increase in range of motion (ROM) and a change in muscle tissue after the application of sports massage techniques of direct pressure, cross-fiber friction and compressions. It was critical for the study to have scientific proof of why sports massage worked, since anecdotal evidence would not be accepted by the allopathic medicine fields.

Given the doubts about the effectiveness of massage, horses, the world's largest athletes, were used as subjects in an experiment to determine if changes in ROM were real and not just psychological. Horses and humans have the same muscles, muscle tendon units and bones, and generally the dynamics of movement are similar. The research aimed to illustrate that an increase in ROM correlated with changes in muscle tissue after the application of the sports massage techniques.

Before the actual grant was awarded, a pilot project was conducted to determine if there was a cause-and-effect relationship resulting from the application of the direct pressure, cross-friction and compressions with an increase in ROM. The preliminary work found an increase in ROM, with an increase in the muscle belly and muscle tendon junction after the techniques were applied. These results provided the basis to pursue the research reported here.

The design of the experiment was set up to measure changes pre- and post-application of sports massage in the transverse diameter of the muscle belly and muscle tendon junctions. Ultrasonic imaging correlated these changes with changes in ROM



With a finger or thumb, the therapist presses straight in for five seconds or more, depending on the tissue and the status of the tissue. Direct pressure is removed when the therapist feels the slightest tissue change.

pre- and post-sports massage through use of a treadmill. The treadmill provided the ability to measure the subject's stride length and stride frequency during a walk and trot sequence, allowing the examiners to control and reproduce the variables of time, distance and speed.

A control group was not included in the experiment, since the subjects were measured against themselves pre- and post-sports massage. All testing was performed on horses of the same breed (standardbred), approximate size and age. The study used a sample group of eight horses from a licensed equestrian facility.

Before the actual data collection, the experimenters conducted a data collection phase that measured stride length and frequency without the application of sports massage to test the reproducibility and consistency of the subject's walk and trot stride lengths and frequencies in the absence of treatment. Seven horses of the same breed, size and approximate age were used, five of which were used later in the study.

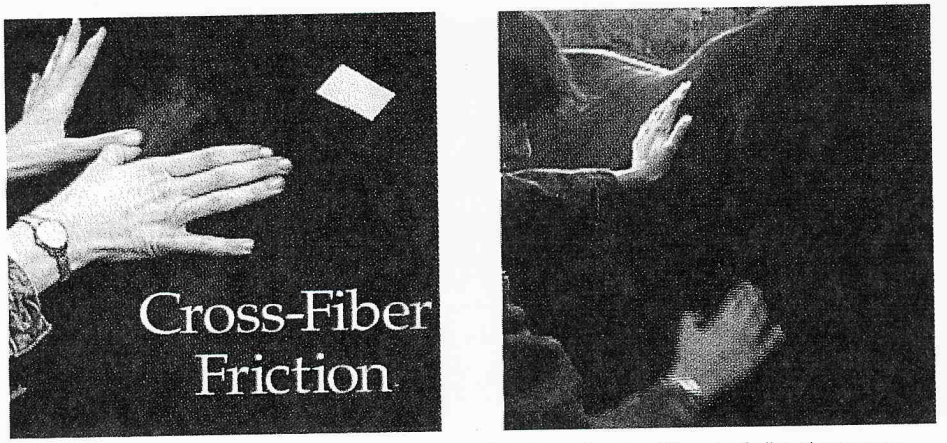
Two trials on each subject were conducted using the identical procedures as in the actual experiment in which stride length and frequency in the absence of sports massage were measured. No significant variation or change in stride frequency or length was found in the two trials.

The core team of professionals included Jo-Ann Wilson, principal investigator and sports massage therapist; Dr. Peter Weyand, biologist, exercise physiologist and statistical analyst; Christine Emery, registered diagnostic medical sonographer and veterinary ultrasound specialist; and Robert Altman, grant administrator.

All subjects were evaluated at Black Walnut Farm, Billerica, Massachusetts, with the permission of Andrew Card, owner of the farm and the horses. The treadmill was borrowed from Harvard University, Department of Organismic and Evolutionary Biology. The ultrasound machine was a General Electric Logic 400 diagnostic unit that was on loan from General Electric. Hard copies of ultrasound images were made with a Sony video printer using thermal paper. In addition, all phases of the experiment were captured on video for the production of an educational documentary.

The four targeted muscle bellies and muscle tendon junctions for the ultrasound imaging were the supraspinatus (shoulder extensor), triceps brachii (shoulder flexor), long head of biceps femoris (hip extensor) and gluteus superficialis (hip flexor). All targeted muscles observed in the study were on the left side of the sub-

Testing was performed on a sample group of eight horses of the same breed, approximate size and age.



Both photos show cross-fiber friction, a stroke that is a direct offshoot of direct pressure. Applied with a fingertip, thumb, braced fingers, or palm of hand, the stroke is the basic push in and hold, with an added back and forth movement across the fibers.

All phases of the experiment were captured on video for a documentary; some freeze-frames are shown above and on Page 96.

jects. In preparation for the experiment, the hair covering the targeted muscles was surgically clipped, shaved and the skin was marked for accurate placement of the ultrasound scan head. Using the diagnostic ultrasound machine, measurements of the muscle bellies and muscle-tendon junctions were taken pre- and post-applications of sports massage. The ultrasound's scan head was positioned perpendicular to each structure measured. The muscles and the muscle tendon junctions were viewed in the transverse and sagittal plane to obtain the anterior to posterior (front to back) measurement in both views. Multiple images of pre- and post-measurements were obtained.

Before the next phase of the experiment is discussed, let's define the three sports massage techniques applied to the origins, insertions (when palpable) and muscle bellies. They are:

1. Direct Pressure

With a fingertip or a thumb, the therapist presses straight in for five seconds or more, depending on the tissue, the status of the tissue, and when the therapist feels the slightest tissue change. "This is the take-off point of sports massage and the premier stroke with which you approach virtually all stress points on the body."[2]

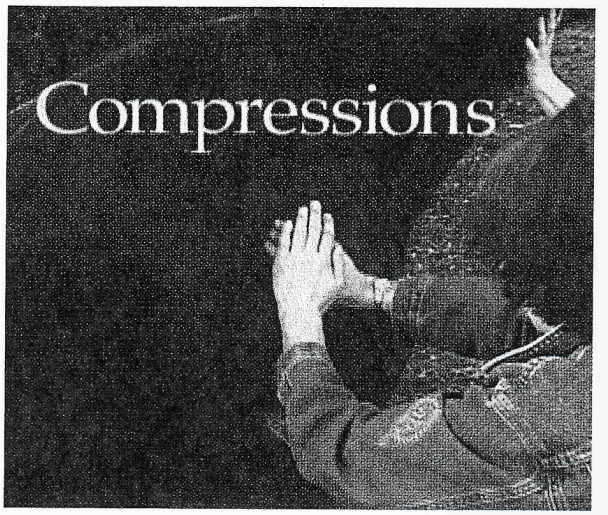
2. Cross-Fiber Friction

Friction is a stroke that is a direct offshoot of direct pressure. Applied with a fingertip, thumb, braced finger, fist or palm of the hand, the stroke is the basic push in and hold with an added component of movement. Move your fingers back and forth, and you have cross-fiber friction. Dr. James Cyriax postulated that deep cross-fiber friction loosened tight muscles by separating muscle adhesions and chronic spasming.[3]

3. Compressions

"Compressions are a rhythmical pumping movement compressing the muscle against the bone and can be applied with the heel of the hand, tips of fingers or a loose fist."[2] In order to assess an increase in ROM, the following procedures were utilized pre- and post-application of the sports massage techniques.

1) The horse was secured on the treadmill without any previous exercise. The treadmill could be regulated for the specific speeds of 8 miles per hour for the walk and 12 miles per hour for the trot. Each horse was walked at 8 miles per hour on the treadmill for 30 seconds to standardize a warm-up before the experiment began. After warm-up, the treadmill was maintained at a speed of 8 miles per hour while the left front hoof fall



Compressions are a rhythmical pumping movement compressing the muscle against the bone, and can be applied with the heel of the hand, tips of the fingers or a loose fist.

The percentage of stride frequency post-massage at the walk was decreased by 4.6 percent and the trot stride frequency decreased by 1.4 percent.

could be counted for 100 strides. The time was recorded for each horse to complete the 100 strides. The same procedure was conducted at 12 miles per hour at the trot. The strides were counted, timed and recorded by two experimenters on the team.

2) After the walk and trot strides were completed and counted, the horses were removed from the treadmill and cooled down for 75 minutes. The cooling down phase included walking for 15 minutes, after which the horses were returned to their stalls.

3) After completion of the cool-down phase, the sports massage techniques of direct pressure, cross-fiber friction and compression were applied for 20 minutes to each horse on the trunk and neck, including origins and insertions at muscle tendon junctions (where palpable) and muscle bellies.

In summary, the steps in the experiment included:

1) Horse hair shaved, clipped and targeted muscle marked.

2) Targeted muscles and muscle tendon junctions imaged using diagnostic ultrasound.

3) Horse placed on treadmill at walk (8 miles per hour) and trot (12 miles per hour).

4) Left front hoof fall counted for 100 strides, timed and recorded at walk (8 miles per hour) and trot (12 miles per hour).

5) Horse removed from treadmill.

6) Horse cooled down for 75 minutes.

7) Horse receives sports massage by principal investigator, Wilson, for 20 minutes using direct pressure, cross-fiber frictions and compressions over trunk and neck at muscle tendon junctions and muscle bellies.

8) Immediately after sports massage, horse is re-ultrasounded on marked muscles and muscle tendon junctions.

9) Horse placed back on treadmill, and steps three and four repeated.

Range Of Motion Findings

Upon the completion of data collection and analysis, a positive trend toward an increase in stride length and a corresponding decrease in stride frequency was found to have occurred following the application of the sports massage techniques. A decrease in stride frequency over distance indicates that more distance was covered per stride. The percentage of stride frequency post-massage at the walk was decreased by 4.6 percent and the trot stride frequency decreased by 1.4 percent. The stride length at the walk was increased, post-sports massage, by 3.6 percent, or 4.8 inches. Stride length at the

Walking	Percent Difference	Increase (In Inches)
Stride Frequency	-4.6%	—
Stride Length	+3.6%	4.8
Trotting	**Percent Difference**	**Increase (In Inches)**
Stride Frequency	-1.4%	—
Stride Length	+1.2%	1.7

Table 1: Changes In Stride Frequency And Length

Muscle Name	Belly	Muscle Tendon Junction
Supraspinatus	+9%	+18%
Triceps Brachii	+34%	+20%
Biceps Femoris	+8%	+20%
Gluteal Superficialis	+5%	+14%

Table 2: Percentage Of Increases In Muscle Tissue

Muscle Diameter	Percent Increase
Muscle Belly	14%
Muscle Tendon Junction	18%

Table 3: Percent Increase In Transverse Diameter Averages

These results provide support for the long-standing belief that sports massage has beneficial effects for both athletic performance and general function.

trot was increased by 1.2 percent, or 1.7 inches (see *Table 1*, above).

Ultrasound Findings

The results of the ultrasound after sports massage showed an increase in the transverse diameter of all four muscle bellies and muscle tendon junctions. This positive trend is evident in the percentage of increase, illustrated in *Table 2*, above.

Interpretations

The measurable changes in the muscle bellies and muscle tendon junctions after the application of sports massage (see *Table 3*, above) may be correlated with the decrease in stride frequency and the increase in stride length.

The etiology of the changes in the structures measured by the ultrasound is not known. Literature on musculoskeletal ultrasound focuses on pathology and injured structures. Since the muscles and muscle tendon junctions researched were not pathological or injured, further research is required to understand the changes that occur to healthy tissue after sports massage. Possible explanations for the changes seen in this study would include changes in vascular resistance and subsequent fluid shifts, and changes in length on position of muscle and tendon fibers.

Conclusion And Recommendations

The sports massage techniques generated measurable changes in the anatomical and/or fluid status of muscle tissue and coincident improvements in gait dynamics, such as an increase in length of stride. Collectively, these results provide support for the long-standing belief that sports massage has beneficial effects for both athletic performance and general function. Observation, and in many cases first-hand experience, has spawned a massage industry whose legitimacy has been all but completely unchallenged by

The study presented here provides important evidence that significant physiological and anatomical changes take place in muscle tissue.

the general public. The results presented here provide important evidence that significant physiological and anatomical changes take place in muscle tissue, and that basic gait mechanics, such as ROM, are improved through the use of three specific sports massage techniques.

The most intriguing finding is that muscle tendon and muscle belly diameters increased by an average of 14 percent and 18 percent, respectively, in the four muscles tested. Although the basis of the alterations assessed using ultrasound images are not fully known at present, the magnitude and consistency of the differences in pre- and post-massage measurements provides strong evidence that acute tissue level changes are produced in muscles that have undergone the specific sports massage techniques of direct pressure, cross-fiber friction and compression. The coincident alterations in gait dynamics, specifically the positive trend for the subjects to take longer strides after the treatment, suggests that sports massage may have a beneficial effect on the mechanics of locomotion as well. Although the post-treatment means were not sufficiently sizable to be statistically significant with a sample size of eight horses, stride length increases were so consistent during trotting that a 1.2 percent increase would have been significant with a slightly larger sample size ($p=0.08$). Although the stride length increases in both gaits were small, ranging from 1.2 percent to 3.6 percent and 1.7 inches to 4.8 inches, respectively, differences of these magnitudes have important implications for athletic performance.

The ultrasound data indicates there was a measurable change in the tissues massaged, and coincident with these changes were positive changes in gait dynamics. Future work, including high-speed video, more subjects and perhaps additional or other imaging techniques, would provide further insight into the effects of sports massage on ROM.

A video was produced for the AMTA Foundation providing a visual presentation of this research project.

In summary, it is exciting to provide preliminary scientific evidence to the massage profession as a way to further its strength as an adjunct to the medical field. Massage has been used for centuries because it works. Hopefully, the results of this project will provide reason to access more extensive research grants from public and private agencies. As alternative and adjunctive therapies such as massage become a part of the larger continuum of health care, it is critical to provide scientific evidence that will further validate the massage profession and strengthen its position as a provider of necessary and quality treatment.

•••

Jo-Ann Wilson, M.Ed., LMT, NCTMB, principal investigator, is currently the director of Wilson and Meagher Associates in Sportstherapy. Wilson was the codirector of the Jack Meagher Institute. As Jack Meagher's associate, Wilson works with both humans and horses. Wilson was the sports massage therapist for horses and riders of the U.S. Equestrian Team, 3-Day Event Team for the 2000 Olympic Games in Australia, winners of the Individual Gold and Team Bronze medals. She can be reached via E-mail at: wmst4@yahoo.com; Web site at: www.sportsmassageinc.com; or by phone at: 978-772-9702.

References

1. Meagher, J. *Beating Muscle Injuries For Runners.* Rowley, Massachusetts: Meagher Publisher, 1986.
2. Meagher, J. *Sportsmassage.* Barrytown, New York: Station Hill Press, 1980.
3. Cyriax, J. and G. Russel. *Textbook Of Orthopaedic Medicine,* Vol. II. Baltimore: Macmillan Publishing Co., Inc., 1977.