



Abstract

Occupational health improved with early intervention of Rapid Release Therapy Sessions in upper extremity overuse syndromes in professional butchers.

Tom Hendrickx, MPT, OCS, CSCS

The effectiveness of Rapid Release Therapy (heretofore RRT) as a preventative treatment device in an occupational setting for professional butchers.

Introduction

Repetitive motion syndrome is a common occupational problem. It often leads to symptoms of pain, numbness, tingling, fatigue, burning and loss of motion and loss of function. Although many companies and employers battle this trend with ergonomic improvements, frequent breaks, change of tasks and employee education, many companies face tremendous worker's compensation insurance costs due to the high incidence of injury.

An occupation that experiences some of the highest repetitive motion syndrome incident rates are professional butchers. These workers spend almost their entire work shift gripping, cutting, slicing, chopping and pounding meat with hand held knives and power saws. Due to the nature of this occupation, butchers complain of upper extremity symptoms from the neck to the hand leading to diagnosis's of cervical radiculopathy, shoulder pain, lateral epicondylitis, medial epicondylitis, carpal tunnel syndrome, trigger finger, DeQuervain's Tendonitis and tenosynovitis.

Professional butcher workers that experienced symptoms of these diagnosis's were identified by the occupational health staff at a pork processing plant and utilized RRT to determine its effectiveness to reduce these symptoms prior to the employee requiring more advanced medical attention and at an increased cost.

Recordable Treatments

When a company administers "treatment" of any type to an employee who complains of symptoms it may be considered "recordable". Certain types of first aide/treatment are considered "non-recordable" such as cold packs, hot packs, and massage. Massage may be manually applied or applied through a mechanical device.

RRT utilizes vibrational therapy at a high frequency to decrease scar tissue, reduce pain, reduce muscle hypertonicity and allows a faster recovery and return to function. It's FDA, class one, medical exempt status classifies it as a mechanical vibration device. It is our goal in this and other occupational studies to apply RRT treatment without it considered a "recordable treatment". At the time of this writing, OSHA has not yet determined if RRT is considered "recordable".

Study Limitations

Although this pork processing company believes in the effectiveness and inherent cost reduction of "non-recordable" RRT treatments it decided to continue through the study as "recordable" to determine the RRT's ability to reduce costs by applying early in the symptom process rather than waiting until employees required more advanced and costly treatments that are also "recordable". With this in mind, this study was limited to the most common hand and wrist injuries and a small sample size to determine its financial and employee benefits.

This study will determine RRT's effectiveness in said applications.

Study Participants

Seven (7) full time working butchers were identified as having symptoms of trigger finger, DeQuervain's tenosynovitis, or carpal tunnel syndrome. Four trigger finger participants included thumb (2), ring finger (1) and long finger (1) cases. The CTS participants included two cases on the same individual with each hand considered a separate case.

Carpal Tunnel Syndrome (CTS)

Both CTS cases responded very well to the RRT treatments. After only two (2) sessions of RRT treatment of two (2) minutes in duration the employees reported 0/10 pain on the Visual Analog Scale (VAS). The left sided case reported complete resolution of symptoms after two sessions and the right case reported complete resolution of symptoms after four sessions and less than 2/10 pain after two sessions.

CTS Comparison

Prior to access to the RRT, this company would "record" on average only two sessions of other conservative "recordable" treatments prior to referring to orthopedics for further evaluation. In many cases, the referral to orthopedics meant more costly and invasive treatments for CTS including, but not limited to, injections, surgery, or bracing and all these options meant time away from full duty. With the RRT cases, not only was the employee able to remain on full duty but the symptoms resolved within 2-4 treatments of 2 minutes each. Although the average of non-RRT sessions compared to RRT cases is the same at 2 sessions, it is the opinion of the Head Athletic Trainer on staff that most CTS cases are referred out after 2 "recordable" sessions versus more conservative care. "By using the RRT we have made cases recordable, however we were able to prevent surgery and additional medical costs with the majority of those cases".
Head Athletic Trainer, Abigail Wilking, ATC.

DeQuervain's Tenosynovitis

The single case of DeQuervain's responded very well to the RRT treatments. After only four (4) sessions of RRT treatment of two (2) minutes in duration the employee reported 0/10 pain on the Visual Analog Scale (VAS).

DeQuervain's Comparison

Prior to access to the RRT, this company would "record" on average only nine (9) sessions of other conservative "recordable" treatments prior to referring to orthopedics for further evaluation. In many cases, the referral to orthopedics meant more costly and invasive treatments for DeQuervain's including, but not limited to, injections, surgery, or bracing and all these options meant time away from full duty. With the RRT case, not only was the employee able to remain on full duty but the symptoms resolved within 6 treatments of 2 minutes each. Compared to the company average of 9 conservative visits, the RRT case responded in four (4) visits which is a 56% reduction in "recordable" visits.

Trigger Finger

All four (4) cases responded very well to the RRT treatments. The two (2) trigger fingers of the fingers responded more quickly and more completely than the two triggering of the thumb cases. After only two (2) sessions of RRT treatment of two (2) minutes in duration the employees with trigger finger reported 0/10 pain on the Visual Analog Scale (VAS). One trigger finger case reported triggering and that resolved completely by the 7th of nine sessions. The other trigger finger reported "locking" and that resolved by the 6th session with only occasional triggering reported on follow-up.

Trigger Thumb

The two (2) trigger thumb cases responded differently to the RRT sessions. Each underwent 6 sessions of RRT for two minutes in duration. The first case reported a 45% decrease in pain and complete resolution of the triggering. The second case reported an 85% decrease in pain and complete resolution of the triggering. Unlike the trigger thumb cases however, the pain on VAS was never reported to be 0/10.

Trigger Finger Comparison

Prior to access to the RRT, this company would "record" on average eleven (11) sessions of other conservative "recordable" treatments prior to referring to orthopedics for further evaluation. In many cases, the referral to orthopedics meant more costly and invasive treatments for trigger finger including injections and surgery and these options meant time away from full duty. With the RRT cases, not only was the employee able to remain on full duty but the symptoms resolved within 6 treatments and there was no time missed from full duty. Compared to the company average of 11 conservative visits, the RRT trigger finger cases responded in two (2) visits which is a 72% reduction in "recordable" visits. Compared to the company average of 11 conservative visits, the RRT trigger thumb cases responded in nine (6) visits which is a 45% reduction in "recordable" visits. Even if you consider the number of sessions to be completely symptom free of triggering or locking at 9 visits that constitutes a 18% reduction of visits compared to company average.

N	Initial Eval	Diag	Side	Pain Description (0=sharp; 1=dull; 2=pressure; 3=stabbing; 4=numbness, 5=intermittent; 6=burn; 7= 2 or more; 8=no pain)	Signs (0=redness; 1=swelling; 2=tender; 3=deformity; 4=limited ROM, 5= FULL ROM)	Grip	Thumb	Finger	ROM Flexion	ROM Extension	Pain Before ttx	Pain after ttx
1	3/11/13	CTS	L	5	4	60	5.8	9.1	65	70	4	0
	3/13/13			4							4	0
	3/18/13			4							0	0
	3/20/13			5	4	57	10.3	9.2	55	62	0	0
	3/22/13			4							0	0
	3/25/13			4							0	0
2	3/11/13	CTS	R	5	4	63.6	8.7	10.7	60	50	2	0
	3/13/13			4							2	0
	3/18/13			4							0	0
	3/20/13			5	4	55	9.9	10.6	75	60	2	0
	3/22/13			4							0	0
	3/25/13			4							0	0
3	1/21/13	TF	R-RF7		4	27					4	4
	4/8/13				4						4	3
	4/23/13				4						0	0
	4/24/13				4	36.3					0	0
	4/26/13										0	0
	4/29/13				4						0	0

	4/30/13			8	5	35.3				0	0
	5/1/13				4					0	0
	5/2/13				4	32.6				0	0
4	1/21/13	TF	R-LF	7	4	30				6	4
	4/8/13				4					4	3
	4/23/13				4					0	0
	4/24/13				4	30				0	0
	4/26/13									0	0
	4/29/13				4					0	0
	4/30/13			8	5	39.3				0	0
	5/1/13				5					0	0
	5/2/13				5	28.3				0	0
5	3/20/13				1					2	0
	3/22/13				1					1	0
	3/25/13	BURN			1	65	6.66	9.6		2	1
	3/27/13				1					2	1
	3/29/13			4						0	0
	4/1/13			8	5	82.3	7.6	10.6		0	0
6	6/16/13	TF Th	R	-	4	40	8.3	5.8		8	7
	6/19/13				5					8	8
	6/25/13				5					8	8
	6/26/13				5	41.4				6	5
	6/28/13				5					5	4
	7/11/13				4					6	4

7	4/4/13	TFTTh2	R	5	4	41	5	5.6	10		7	5
	4/6/13				4						4	4
	4/8/13				4						4	4
	4/26/13			N	N	46	6.3	4.8	15		2	2
	4/29/13				4						2	1
	5/1/13				4						1	1

VAS

The visual analog scale is a frequently used scale in the medical field to determine one's level of discomfort. 0/10 is no pain and 10/10 is the highest level of pain imaginable. In many settings, the goal of the treatment is to reduce the discomfort to 3/10 or less for that often is a functional level of discomfort for individuals to continue their previous level of function. With this in mind, all seven study participants reached a level of <3/10 discomfort within four (4) sessions of RRT and five (5) of the seven participants reached <3/10 discomfort within two (2) sessions of RRT treatments.

Review of Findings

Compared to the company average of conservative “recordable” care visits, the RRT cases responded as follows:

	Company Average	RRT Sessions To Be Painfree	Percentage (%) Improved
CTS	2	2	0%
DeQuervain's	9	4	55%
Trigger Finger	11	2	72%
Trigger Thumb	11	6	45%

Discussion

Statistically, the CTS cases appear to be on average with company protocol. However, because CTS causes numbness and loss of grip strength it is potentially the most dangerous condition to the butcher employee with a substantially increased risk for further injury. For this reason the company only averages two conservative sessions of recordable care versus 9-11 with other pain dominant diagnosis's. In both of these CTS cases, the employees responded so quickly to the RRT treatments that further orthopedic intervention was unnecessary reducing costs and keeping the employee at work. The opinion of the Athletic Trainer on Staff was the RRT treatments likely avoided surgery in multiple cases.

Conclusion

Seven professional butchers underwent RRT sessions to determine its effectiveness for use in a industrial setting to prevent further medical intervention while maintaining full time work status. 42 RRT sessions were performed.

The elicitation of the TVR in the neuromuscular system is essential to maximize the benefits of vibration therapy. The evidence demonstrates that only a frequency between 100-200 Hz will activate the TVR, and allow the direct vibration therapy to target scar tissue. Only the precise combination of frequency, amplitude and motor neuron excitation can uncouple the co-contraction of agonists-antagonists. Lastly, measurable vibration therapy enhances the excitement of cortico-spinal pathways to assist in the activation of cortical motor areas. This allows the RRT to be effective in nearly every stage of treatment (acute to chronic) and assist the practitioner in assisting the injured worker with a shorter recovery.

The evidence of this study is supportive of vibrational therapy is effective on professional industrial butchers when RRT was used as a treatment modality. All study participants improved with nine or fewer sessions and the percentage of improvement compared to company average of “recordable” conservative care was 0-56% dependent on diagnosis.

Recommendations for future use of RRT suggest that RRT is highly effective in preventative treatment of the upper extremity for professional butchers in an industrial setting.

Treatment Time

In all cases in this study it was determined in advance that each treatment session would be of 2 minutes duration. This determination is based on RRT's findings and results with other such cases. In future cases and studies, a second group of similar diagnosis's with longer treatment protocols will be compared to this series of cases to determine if a longer three (3) minute treatment protocol would be more or less effective compared to the two (2) minute protocol administered in this study.

Recordable Sessions

To this end, OSHA has not yet determined if RRT is an recordable session in an occupational setting. If, as desired, OSHA deems the RRT “non-recordable” then a much larger sample size of industrial upper extremity diagnosis's can be evaluated and studied to determine if these findings are consistent with a much larger sample size and diagnosis spectrum.

Review of Literature

A review of related literature shows that mechanical vibration (10-200 Hz) directly administered to tendons or muscles can cause a reflex response (Hagbarth and Eklund, 1965). This particular reflex activity has been named the "tonic vibration reflex" (TVR) (Latash 1998). Echlin and Fessard (1938) learned that muscle spindles are sensitive to vibration.

Because the muscle spindle is sensitive to small changes in muscle length, the discharge rate of the muscle spindle is strongly modulated by muscle vibration, which induces repeated changes in muscle fiber length. The discharge rate of Ia afferents increases linearly with the frequency of vibration up to 500 Hz (Brown, 1967).

Johansson et al. (1990) states that the fusimotor system, after integrating input from the afferent nerves of skin, muscles, and joints serves as a final common path for the regulation of muscle stiffness.

Direct Vibration is normally applied to muscle or tendon at a high frequency (100-150 Hz), at a small amplitude (1-2 mm) for a short period of time (2-15 sec), resulting in a transient increase in muscle activity known as the tonic vibration reflex. TVR requires vibration to be directly applied to the muscle or tendon at high frequencies (100-200 Hz) Cochrane (2011).

Nogier identified 6 frequencies of vibration that resonant with different types of body tissues. His second frequency, at 147 Hz was found to resonant directly with fibrotic yellow scar tissue without harmful effects to the surrounding tissues.

Evidence from acute direct vibration studies suggest that an excitatory response of the muscle spindle occurs, which activates the Ia afferents. These afferents in turn, excite the alpha motor neuron of the surrounding muscles, which uncouples the co-contraction of agonists-antagonists (Eklund and Hagbarth, 1966).

Additionally, there is evidence to support the notion that cortical areas of the brain receive and process proprioceptive information when direct vibration is applied, which generates evoked cortical potentials (Munte et al., 1996). Moreover, it has been reported that Ia afferent input has the ability to excite the corticospinal pathways (Carson et al., 2004) and activate the cortical motor areas (Lewis et al, 2001)

References

Brown MC, Engberg I, Matthews PB. The relative sensitivity to vibration of muscle receptors of the cat. *J. Physiology*. 192, 773-800. 1967

Carson RG, Rick S, Mackey DC, Meichenbaum DP, Willms K, Forner M, Byblow WD. Excitability changes in human forearm corticospinal projections and spinal reflex pathways during rhythmic voluntary movement of the opposite limb. *Journal of Physiology-London* 560, 929-940. 2004.

Cochrane DJ. The potential neural mechanisms of acute indirect vibration. *Journal of Sports Science and Medicine* 10, 19-30. 2011.

Echlin F, Fassard A. Synchronized impulse discharge from receptors in the deep tissue in response to a vibrating stimulus. *J. Physiology*. 161, 282-297. 1938

Eklund G, Hagbarth KE. Motor effects of vibratori stimuli in man. *Electroencephalography and Clinical Neurophysiology* 19, 619. 1965.

Eklund G, Hagbarth KE. Normal Variability of tonic reflexes in man. *Experimental Neurology*. 16:80-92, 1966.

Johansson H, Sjolander P, and Soja P. Activity in receptor afferents from the anterior cruciate ligament evokes reflex effects on fusimotor neurons. *Neuroscience Res.*, 8:54-59, 1990.

Latash ML. *Neurophysiological basis of movement*. Human Kinetics, Champaign. IL

Lewis GN, Byblow WD, Carson RG. Phasic modulation of corticomotor excitability during passive movement of the upper limb: Effects of movement frequency and muscle specificity. *Brain Research*. 900, 282-294. 2001.

Mundt TF, Jobges EM, Wieringa BM, Klein S, Schubert M, Johannes S, Dengler R. Human evoked potentials to long duration vibratory stimuli: Role of afferents. *Neuroscience Letters*. 216, 163-166. 1996.

Lau, YL, Nosaka, K. Effect of vibration treatment on symptoms associated with eccentric exercise-induced muscle damage. *Am. J. Phys. Med. Rehabil.* Vol 90, No. 8, August 2011.

Dr. Charles McGee, MD, *Healing Energies of Heat and Light*, MediPress, 2000, p. 117. Dr. Nogier, French Neurologist, frequency settings.

