Military Students Return to Duty Faster with High Frequency Vibration Therapy.
Tom Hendrickx, MPT, OCS, CSCS

The effectiveness of Rapid Release Therapy (heretofore RRT) as a treatment device in a military environment for soft tissue injuries that required absence from full duty.

Introduction
Military students underwent Rapid Release Therapy (RRT) sessions to determine its effectiveness for use in a military training environment. RRT utilizes vibrational therapy at a high frequency to release scar tissue, reduce pain and inflammation, and ultimately allow faster rehabilitation from soft tissue injury. This study will determine RRT's effectiveness in said applications.

Military students at a Southern California base underwent RRT sessions when presenting with soft tissue injuries that required partial or complete absence from duty. Marine students enter multiple grueling 10 week training regimens that include multiple sessions per day. These sessions may include marching, running, hiking, climbing, and jumping for long durations while simultaneously carrying a 80 pound backpack. Musculoskeletal injuries accumulate quickly in this environment. Presenting most frequently to the medical staff are injuries to the lower extremities. Plantarfascitis, shin splints, anterior knee pain, iliotibial band syndrome are most frequently reported to the training room. Another condition known as "pack palsy" is also frequently reported. This presents as a compression on the brachial plexus from the long durations of carrying the backpack of 80 pounds or more. Shoulder pain, neck pain and elbow syndromes are also frequently encountered. RRT was utilized for these conditions and compared to current training room protocols without the RRT and the outcomes are listed below.

Types of Conditions Treated	# per condition	
Ilio Tibial Band Syndrome (ITBS)	5	
Calf Strain	3	
Hamstring Strain	2	
Anterior Tibialis Tendonitis	2	
Inferior Patellar Tendonitis	2	

Ankle Sprain	2	
Achilles Tendonitis	1	
Calf Tear	1	
Medial Tibial Stress Syndrome (MTSS)	1	
Biceps Strain	1	
Pack Palsy/Rhomboid Strain	1	
Shin Splints	1	
Tibial Stress Fracture	1	

Previous Treatment Protocols

Prior to having access to Rapid Release Therapy soft tissue injury protocols included injury education, exercise instruction that includes active warm up, stretching and stability exercises, cold packs and an independent exercise program. Very few modalities are utilized due to time, staff and department limitations. The average number of visits to the training room was 7.1 and days away from full duty was 16.4.

Student	Injury	# of Tx	Light Duty	Status			
1	Bilateral ITBS	4	6	Return to full duty (RTFD) with no pain			
2	Achilles Tendonitis	5	14	RTFD with no pain			
3	ITBS	3	16	RTFD with no pain			
4	Ant. Tib Tendonitis	3	3	RTFD with approx. 80% improvement			
5	Hamstring Strain	3	3	RTFD with no pain			
6	Hamstring Strain	3	3	RTFD no pain jogging, some pain with sprinting			
7	ITBS	3	5	Return with no pain			
8	Calf Tear	10	50	Minimal Improvement, MRI revealed tear, medically dropped			
9	Calf Strain	4	8	RTFD with no pain			
10	Infrapatellar Tendonitis	6	11	Minimal improvement.Medically dropped			

11	Bilateral MTSS	6	23	Temporary improvement after use. Medically dropped			
12	Infrapatellar Tendonitis	6	8	Good improvement/pain relief 80%. Needs to continue HEP. RTFD			
13	Biceps Strain	2	2	Reduction in pain after first treatment.			
				No pain at rest and full 5/5 MMT. Pain wit pull ups			
14	Calf Strain	3	3	RTFD. Significant pain relief and improved ROM			
15	Pack Palsy/Rhomboid Strain	6	14	RTFD wit pain releif. Some pain while wearing heavy pack.			
16	ITBand/Meniscus Tear	5	14	ITBS resolved. Dropped from training due to meniscus tear			
17	Ankle Sprain	4	9	RTFD. Sig. pain relief and increased ROM. Continue HEP			
18	Ankle Sprain	3	16	RTFD. Sig. pain relief and increased ROM. Continue HEP			
19	Calf Strain	2	4	Significant improvement. Inc ROM, Dec Pain. Dropped medically			
20	ITB/knee infection	4	14	ITBS resolved. Remained on light duty due to infection			
21	Bilat. Shin Splints/stress fracture	7	24	RTFD with no pain			
22	Anterior Tibialis Tendonitis	3	14	RTFD. Minimal soreness after prolonged running activities			
23	Tibial Stress Fracture	4	21	Currently on light duty for stress fracture. No pain with walking			

Current Treatment Protocols

With the addition of Rapid Release Therapy, the Athletic Trainers and medical staff decided to compare their previous soft tissue protocols with the addition of RRT. Each diagnosis and private was treated by previous protocol with the addition of a specific RRT protocol for that exact diagnosis. When comparing previous protocols with the new that included the RRT the average number of visits reduced to 4.30 and days off full duty to 12.4. This is a 40% reduction in treatments and a 25% reduction in number of days away from full duty.

Medically Dropped

In the case of five students their condition was considered to be serious enough for medical discharge. This means that no matter the intervention, the medical staff determined the student was unlikely to return to full duty in a required timeframe. When these five students are removed from consideration in the study because they would have failed medically with or without the RRT then the results are interpreted differently. Compared to the previous protocols without RRT and the 18 medically allowed students treated with RRT the reduction in number of treatments is 46% and the number of days away from full duty is 38%.

			Days on	
Student	Injury	# of Tx	Light Duty	Status
1	Bilateral ITBS	4	6	Return to full duty (RTFD) with no pain
2	Achilles Tendonitis	5	14	RTFD with no pain
3	ITBS	3	16	RTFD with no pain
4	Ant. Tib Tendonitis	3	3	RTFD with approx. 80% improvement
5	Hamstring Strain	3	3	RTFD with no pain
6	Hamstring Strain	3	3	RTFD no pain jogging, some pain with sprinting
7	ITBS	3	5	Return with no pain
9	Calf Strain	4	8	RTFD with no pain
12	Infrapatellar Tendonitis	6	8	Good improvement/pain relief 80%. Needs to continue HEP. RTFD
13	Biceps Strain	2	2	Reduction in pain after one treatment. Treated again and feeling better.
14	Calf Strain	3	3	RTFD. Significant pain relief and improved ROM
15	Pack Palsy/Rhomboid Strain	6	14	RTFD wit pain releif. Some pain while wearing heavy pack.
17	Ankle Sprain	4	9	RTFD. Sig. pain relief and increased ROM. Continue HEP
18	Ankle Sprain	3	16	RTFD. Sig. pain relief and increased ROM. Continue HEP
20	ITB/knee infection	4	14	ITBS resolved. Remained on light duty due to infection
21	Bilat. Shin Splints/stress fracture	7	24	RTFD with no pain
22	Anterior Tibialis Tendonitis	3	14	RTFD. Minimal soreness after prolonged running activities
23	Tibial Stress Fracture	4	21	Currently on light duty for stress fracture. No pain with walking
8	Calf Tear	10	50	Minimal Improvement, MRI revealed tear, medically dropped
10	Infrapatellar Tendonitis	6	11	Minimal improvement. Medically dropped
11	Bilateral MTSS	6	23	Temporary improvement after use. Medically dropped
16	ITBand/Meniscus Tear	5	14	ITBS resolved. Dropped from training due to meniscus tear

			Days on	
19	Calf Strain	2	4	Significant improvement. Increased ROM and reduction of pain.
				Dropped Medically

Review of Vibration 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.

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).

The significance of this study is indicated to support the evidence of the effectiveness of RRT on military personnel and their musculoskeletal tissue. This study will provide evidence of the effectiveness of RRT to shorten the treatment duration and allow military trainees to return to duty in less time than traditional soft tissue methods.

Methodology

23 Military students were treated using the RRT for a variety of soft tissue injuries in the training room of a Southern California Military Base. In many cases, the privates were removed from all physical training activities due to the severity of their case. In other cases, as indicated in chart 1, the students were undergoing treatment while continuing training requirements.

Injury Treatment

23 students used RRT for treatment of various musculoskeletal disorders including ITBS, Inferior patellar tendonitis, ankle sprains, calf strains, hamstring strains, and anterior tibialis tendonitis and many others soft tissue conditions. (See chart 1)

Privates were asked to determine the level of discomfort using a visual analog scale (VAS) for pain, with 0 being no pain and 10 being worst pain. However, the primary measurement of success in this study was determined by the number of days on light duty.

Treatment time for all musculoskeletal disorders was between 2 to 5 minutes.

Taking the VAS scale pre-therapy and again post-therapy, the average improvement for each student is outlined below.

Student	Pre-Therapy Pain Rating 0/10	Post-Therapy Pain Rating 0/10	Diagnosis
1	4	0	Bilateral ITBS
2	5	0	Achilles Tendonitis
3	/	0	ITBS
4	5	2	Ant. Tib Tendonitis
5	/	0	Hamstring Strain
6	/	1	Hamstring Strain
7	4	0	ITBS
8	7	6	Calf Tear
9	6	0	Calf Strain
10	5	5	Infrapatellar Tendonitis
11	6	5	Bilateral MTSS
12	6	2	Infrapatellar Tendonitis
13	5	2	Biceps Strain
14	/	1	Calf Strain
15	7	3	Pack Palsy/Rhomboid Strain
16	6	4	ITBand/Meniscus Tear
17	/	2	Ankle Sprain
18	6	3	Ankle Sprain
19	5	2	Calf Strain
20	6	5	ITB/knee infection
21	5	0	Bilat. Shin Splints/stress fracture
22	/	1	Anterior Tibialis Tendonitis
23	6	4	Tibial Stress Fracture

Conclusion

23 Military students underwent RRT sessions in combination with the previously prescribed exercise regimens. When comparing the outcomes of all three considerations the results are as follows:

	Avg. Treatments	Avg. # of days away from full duty
Previous Protocol (without RRT)	7.1	16.4
Current Protocol (with RRT)	4.3	12.4
Excluding medically dropped	3.9	10.2

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 corticospinal 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 athlete in pre-workout power and post workout recovery.

The evidence of this study is supportive of vibrational therapy is effective on military students when RRT was used as a treatment modality in addition to the previous treatment protocols. Due to its ease of use and short treatment times, the RRT was successfully introduced into this high volume, high incidence environment.

Recommendations for future use of RRT suggest that RRT is highly effective in injury treatment, allowing athletes and non-athletes alike to recover more quickly and return to full duty in a fewer number of days.

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