



## **Abstract**

### **Professional Athletes Reduce Pain and Enhance Athletic Performance with High Frequency Vibration Therapy. Tom Hendrickx, MPT, OCS, CSCS**

The effectiveness of Rapid Release Therapy (heretofore RRT) as a treatment device in a professional sports environment in three different applications: injury treatment, pre-workout and post workout.

#### **Introduction**

NFL athletes underwent an intensive five week off season strength and conditioning program in three different settings, utilized RRT in three different applications to determine its effectiveness for use in a professional sports environment. RRT utilizes vibrational therapy at a high frequency to theoretically decrease scar tissue, reduce pain and inflammation, faster rehabilitation from injury, increase blood circulation and decrease lactic acid in muscle tissue. This study will determine RRT's effectiveness in said applications.

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).

The significance of this study is indicated to support the evidence of the effectiveness of RRT on professional athletes and their superior musculoskeletal tissue.

### **Methodology**

25 professional NFL football players choose to use RRT for either injury treatment, pre workout warm-up or post workout recovery. In total, 825 sessions were performed.

### **Injury Treatment**

9 players used RRT for treatment of various musculoskeletal disorders including pectoral strain (2), pectoral repair (1), biceps strain (1), triceps pain and limitations (2, both post operative), quadriceps strain (1), lumbar strain (1), and gastronomies strain (1). Athletes remained in full time training during the two week period of RRT treatment.

Players 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.

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

Taking the VAS scale before and five minutes after each treatment session, the average improvement for each session was 46%. When asked how many sessions it took to feel significantly better (defined as not feeling any additional treatment was necessary) the average number of RRT sessions required to reach "significantly better" was 4.

### **Pre Workout Warm Up**

7 players chose to use the RRT for Pre workout warm up. When used for pre workout warm up it was recommended that the RRT be applied in addition to their traditional warm up routine.

Treatment time for all pre workouts RRT warm up was between 5 to 7 minutes.

Athletes were asked if the RRT used for Pre workout warm up was ineffective or minimally, moderately, or very helpful compared to a warm up program without the RRT application. 4 players (57%) reported that the RRT warm up program was very helpful and 3 players (42%) reported it was moderately helpful. No players (0%) reported that the RRT application was minimally helpful or ineffective.

### **Workout Recovery**

9 players chose to use the RRT application as a recovery method based on the research that direct vibration decreases both the intensity and duration of Decreased Onset Muscle Soreness (Lau, 2011).

RRT treatment time was between 5 to 7 minutes.

Athletes were asked if the RRT used for workout recovery was ineffective or minimally, moderately, or very helpful compared to a recovery program without the RRT application. 6 players (66%) reported that the RRT warm up program was very helpful and 3 players (33%) reported it was moderately helpful. No players (0%) reported that the RRT application was minimally helpful or ineffective.

The results come from using a different VAS scale with 0 being no muscle soreness and 10 is worst muscle soreness, players were given the VAS before and again before the following workout, the average improvement for each session was 65%. When asked how many sessions it took to achieve this result the average number of RRT sessions required to reach was 2.

After the five week training regimen the athletes were asked if they would accept additional treatments, 21 of 25 responded yes.

After the five week training regimen the athletes were asked if they would like their teams' training room to have RRT devices available during the season, 25 said yes.

### **Conclusion**

Twenty five professional athletes underwent an intensive five week off season strength and conditioning program utilizing RRT in three different applications to determine its effectiveness for use in professional sports. 825 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 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 professional athletes when RRT was used as a treatment modality. All twenty five athletes who participated in this study reported RRT as either very helpful or moderately helpful in their injury treatment or performance enhanced abilities. No athletes reported RRT as ineffective or not helpful.

Recommendations for future use of RRT suggest that RRT is highly effective in injury treatment, pre-workout for performance enhancing abilities, and post-workout for delayed onset muscle soreness for professional athletes and non-athletes alike.

## RRT Treatment Results

### Athlete 1-pec

Treatment	VAS before	VAS immed after	Change	% Change	VAS 5 min after	Change	% Change
1	8	3	5	62.5%	4	4	50.0%
2	7	4	3	42.9%	4	4	42.9%
3	6	3	3	50.0%	3	3	50.0%
4	5	3	2	40.0%	3	2	40.0%
5**	4	2	2	50.0%	2	2	50.0%
avg change				49.1%			46.6%

### Athlete 2-pec

Treatment	VAS before	VAS immed after	Change	% Change	VAS 5 min after	Change	% Change
1	9	4	5	55.6%	3	6	66.7%
2	8	4	4	50.0%	3	5	62.5%
3	6	3	3	50.0%	2	4	66.7%
4**	6	3	3	50.0%	2	4	66.7%
5	4	2	2	50.0%	1	3	75.0%
6	3	1	2	70%	2	1	33.3%
7	5	1	4	80.0%	2	3	60.0%
8	2	1	1	50.0%	1	1	50.0%
avg change				56.5%			60.1%

### Athlete 3-biceps

Treatment	VAS before	VAS immed after	Change	% Change	VAS 5 min after	Change	% Change	
1	7	4	3	42.9%	3	4	57.1%	
2	7	4	3	40.0%	3	4	57.1%	triceps 2
3	5	3	2	40.0%	3	2	40.0%	quad
4**	3	3	0	0.0%	3	0	0.0%	lumbar
5	3	2	1	30.0%	2	1	33.3%	gastroc
6	5	1	4	80.0%	2	3	60.0%	
7	2	1	1	50.0%	2	0	0.0%	
8	2	1	1	50.0%	1	1	50.0%	
avg change				42.4%			37.2%	

### Athlete 4-triceps

Treatment	VAS before	VAS immed after	Change	% Change	VAS 5 min after	Change	% Change
1	7	4	3	42.9%	3	4	57.1%
2	7	4	3	40.0%	3	4	57.1%
3	5	3	2	40.0%	3	2	40.0%
4	3	3	0	0.0%	3	0	0.0%
5	3	2	1	30.0%	2	1	33.3%
6**	5	1	4	80.0%	2	3	60.0%
7	2	1	1	50.0%	2	0	0.0%
avg change				40.0%			35.4%

### Athlete 5-triceps

Treatment	VAS before	VAS immed after	Change	% Change	VAS 5 min after	Change	% Change
1	6	2	4	66.7%	2	4	66.7%
2	6	2	4	70.0%	3	3	50.0%
3	5	3	2	40.0%	3	2	40.0%
4**	3	3	0	0.0%	3	0	0.0%
5	5	2	3	60.0%	2	3	60.0%
6	4	1	3	80.0%	2	2	50.0%
7	2	1	1	50.0%	2	0	0.0%
avg change				50.0%			38.1%

### Athlete 6-quadriceps

Treatment	VAS before	VAS immed after	Change	% Change	VAS 5 min after	Change	% Change
1	9	4	5	55.6%	3	6	66.7%
2	7	4	3	40.0%	3	4	57.1%
3	6	4	2	33.3%	2	4	66.7%
4	6	3	3	50.0%	4	0	0.0%
5	5	2	3	60.0%	2	3	60.0%
6	4	2	2	50.0%	1	3	75.0%
7**	3	2	1	30.0%	1	2	66.7%
8	2	1	1	50.0%	1	1	50.0%
9	2	1	1	50.0%	1	1	50.0%
avg change				50.0%			58.4%

**Athlete 7-lumbar**

<b>Treatment</b>	<b>VAS before</b>	<b>VAS immed after</b>	<b>Change</b>	<b>% Change</b>	<b>VAS 5 min after</b>	<b>Change</b>	<b>% Change</b>
1	7	5	2	28.6%	4	3	42.9%
2	5	4	1	20.0%	3	2	40.0%
3**	4	2	2	50.0%	2	2	50.0%
4	4	2	2	50.0%	2	0	0.0%
5	4	2	2	50.0%	2	2	50.0%
6	4	2	2	50.0%	1	1	75.0%
7	3	2	1	30.0%	2	1	33.3%
8	3	2	1	30.0%	2	1	33.3%
9	3	2	1	30.0%	2	1	33.3%
<b>avg change</b>				<b>40.0%</b>			<b>48.7%</b>

**Athlete 8-gastroc**

<b>Treatment</b>	<b>VAS before</b>	<b>VAS immed after</b>	<b>Change</b>	<b>% Change</b>	<b>VAS 5 min after</b>	<b>Change</b>	<b>% Change</b>
1	6	3	3	50.0%	3	3	50.0%
2	5	4	1	20.0%	3	2	40.0%
3	5	3	2	40.0%	2	3	60.0%
4	4	2	2	50.0%	2	2	50.0%
5	2	1	1	50.0%	2	0	0.0%
6	2	2	0	0.0%	1	1	50.0%
				<b>40.0%</b>			<b>41.7%</b>

**Athlete 9-Achilles**

<b>Treatment</b>	<b>VAS before</b>	<b>VAS immed after</b>	<b>Change</b>	<b>% Change</b>	<b>VAS 5 min after</b>	<b>Change</b>	<b>% Change</b>
1	9	3	6	66.7%	3	6	66.7%
2	6	2	4	70.0%	3	3	50.0%
3	6	3	3	50.0%	4	2	33.3%
4	4	2	2	50.0%	3	1	25.0%
5**	5	2	3	60.0%	2	0	0.0%
6	4	1	3	80.0%	2	2	50.0%
7	2	1	1	50.0%	2	0	0.0%
<b>avg change</b>				<b>60.0%</b>			<b>40.7%</b>

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