

Neurac Training in Muscle Rehabilitation

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Abstract

Musculoskeletal disorders are bane not only for sportsmen but many ordinary people that are not engaged in sports. Studies have shown that pain, injury and inactivity can disturb our neuromuscular systems. It is well documented that pain and inactivity reduce muscle force and activation patterns. Neurac is an abbreviation for NEURomuscularACTivation, it's a treatment method that aims to regain normal functional movement patterns in patients with musculoskeletal disorders by using high levels of neuromuscular stimulation. The development of the new Neurac method has emerged from the S-E-T concept (Suspension Exercise Therapy). Kinetic chains, these are the chain of events that affects the movement of neighboring joints and segments. With the neurac method 'weak link testing' is performed in order to assess the body's performance. Open and closed kinetic chains exercises combined with neurac method has provided results of better muscular activation. Suspension training provides alternative instability to the core, upper and lower limbs. The instability is supposed to activate or increase muscle activation which helps in stabilisation. The existing literature is insufficient to draw confirm conclusion regarding its ability to do muscle activation.

Keywords: Neurac Training; Weak Muscle Links; Muscle Activation.

Introduction

Musculoskeletal disorders are troubling not only for sportsmen but many ordinary people that are not engaged in sports. According to BLS, MSD's are the largest category of injuries and U.S. companies spent 50 billion dollar on direct costs of MSD's in 2011 (source: CDC). Studies have shown that pain, injury and inactivity can disturb our neuromuscular systems. It is well documented that pain and inactivity reduce muscle force and activation patterns. The loss of muscle control impairs the ability to stabilize a joint properly through its range of motion. Overtime this leads to muscle strains, abnormal movement strategies, much more pain and limitation.

Neurac is an abbreviation for NEURomuscularACTivation, it's a treatment method that aims to regain normal functional movement patterns in patients with musculoskeletal disorders by using

high levels of neuromuscular stimulation. It includes the use of Redcord suspension system to regain neuromuscular control and function. Kim et al. demonstrated that Neurac sling exercise is a successful method for decreasing pain, correcting postural balance, and activate normal muscular pattern in patients with chronic low back pain. This is a dynamic treatment approach which has four fundamental components: 1. Body-weight-bearing activities using the Redcord sling system, 2. Controlled vibration to selected body parts, 3. Gradual increased resistance (workload), 4. No pain or no increase of existing pain. Also in addition, a newly developed vibration apparatus, Redcord Stimula, can be utilized to enhance neural adaptations. The Neurac method also incorporates testing systems that assess and evaluate the neuromuscular function of kinetic chains, with an emphasis on the integration of "local" and "global" muscle function.

The development of the new Neurac method has emerged from the S-E-T concept (Suspension Exercise Therapy). The Suspension Exercise Therapy (SET) system from Norway has been utilised for musculoskeletal disorders and for athlete training. The functions of SET include assessment of muscular dysfunction, re-establishment of normal

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patterns of movement, injury prevention, performance enhancement, enhance proprioceptive and neuromuscular control, core muscle training, prevention of joint deterioration, and relieves muscular tension and pain.

The Redcord Trainer was initially introduced in 1991. The device was at first called TrimMaster, later renamed Te-rapiMaster and now named Redcord Trainer. After few years of developing exercise and treatment regimens, the utilization of the apparatus was systematized and described in "Fysioterapeuten" in 2000 as S-E-T (Sling Exercise Therapy) (Kirkesola G. 2000). In 2002 manual perturbation was added to the ropes of the Redcord Trainer, as this appears to enhance the treatment effect for some patients. Three years later the development of a mechanical vibration device was initiated, which could be attached to the ropes in the Redcord Trainer. The theoretical argument for this was that muscle spindles respond better to frequencies higher than those possible to achieve by manual perturbation (Fujiwara K et al., 2006).

There are numerous speculations that have impacted the development of neurac method. Firstly Kinetic chains, these are the chain of events that affects the movement of neighboring joints and segments. Due to injuries, weakness, instability and poor biomechanics athletes can develop weak links. With the neurac method 'weak link testing' is performed in order to assess the body's performance. Open and closed kinetic chains exercises combined with neurac method has provided results of better muscular activation (Irish et al. 2010). Dannelly et al. composed closed kinetic exercises on the basis of sling exercise training and determined that sling-based closed kinetic exercise substantially influenced the muscle strength of the lower extremities. (Croy et al. 2011).

Second theory is based on core stability training, Bergmark described a stabilization model for the lower back where he used the terms "local" (deep) – and "global" (superficial) muscles (Bergmark A. 1989). This model has later been produced and renewed by Mottram and Comerford (Mottaram et al. 1998). Danneels et al. 2002 observed that uncoordinated patterns of the multifidus muscle (a deep muscle of the lumbar spine) and the trunk muscles occurred, and Silfieset et al. 2005 observed irregular mobilization patterns in which mobilization of global muscles increased and activity of deep muscles decreased. These changes placed a load on and moved the spine, triggering recurrent low back pain. Sling exercise therapy has been proposed to activate local spine stabilizers during

the activity in pain free manner without substitution of global muscles. Stuge B et al. 2004 proposed that increased activation of local stabilizer muscles with the sling exercise therapy may have contributed to enhanced outcomes compared to traditional therapy.

Third, Gojanovica B et al. 2011 observed that vibratory stimulation can enhance muscle contraction by stimulating muscle hypertrophy, thereby affecting the muscle spindles. Mikhael M et al. 2010 observed that Type Ia afferent fibers are co-activated by α - γ motor neurons. They are activated during isometric contraction, and vibratory stimulation improves the strength of the muscular contraction by increasing the firing rate of Type Ia fibers, and the excitability of α motor neuron. Rittweger et al. 2010 observed that a group with lumbar pain that was treated with vibration and exercise together saw a decrease in pain and an enhanced ability to control nerve roots.

Behm et al (2010) reported that the benefit of an unstable training environment can increase core activation. Behm and Colado (2012) also observed that resistance training programs with instability achieved average 22% gains in functional performance measures.

Stray Pedersen J.I et al did a study in 2006 on sling exercise training improves balance, kicking velocity and torso stabilization strength in elite soccer players. This study is performed to quantify the impact of sling exercise training core stability program on postural balance, kicking velocity and functional core strength. It was controlled trial training session were given 2 days for 8 weeks. 12 subjects were recruited, all are soccer players (age range 19-29). Training sessions consisted of eight different exercises and with each exercises resistance and instability level increased. The outcome measures that are assessed were maximal kicking velocity, static balance and functional strength of pelvic and torso. Significant improvements were seen in outcome measures after sling exercise training. It was seen that balance deficits were eliminated but it is unclear what part of training had the most effect. It is likely that sling exercise training provides unstable base for enhancing neuromuscular control and joint stability.

Stephen Seiler et al., in 2006 performed a study to examine the effects of sling exercise training on maximal clubhead velocity in junior golfers. It was a controlled trial, 2 teams of junior male golfers consist of 10 players each were recruited Age range 17-18yr. The Sling Exercise Training (SET, n=10) group averaged 15+ 2 years old with a 13 handicap. The

control group (CON, n=10) averaged 15+ 3 yrs with a 6 handicap. While SET performed a specialized core stability training program 2 days/week, the control group engaged in traditional strength training exercises 2 days/wk. Both groups trained for 9 weeks. The exercises were progressed in difficulty by increasing resistance and degree of instability. Positive results were seen, significant enhancement in the performance of SET group was observed. The driving velocity increases in the SET group as compare to the control group. It was suggested that SET system allows the improvement in the performance by stabilizing and reactivating core musculature. Max P. Prokopy et al, in 2008 performed a study to evaluate the effects of closed-kinetic chain upper-body training improves throwing performance of NCAA division I softball players. This study compares the effect of training with CKCRT (using sling exercise training) and OKCRT in strength, power, and throwing velocity. 14 female National Collegiate Athletic Association Division I softball player volunteers were blocked and randomly allocated into two groups: CKCRT and OKCRT. Training is done three times weekly for 12 weeks. Outcome measures were assessed pretraining and postraining program and includes isokinetic concentric phase peak torque for shoulder flexion, extension, internal rotation, and external rotation; dynamic single-leg balance; throwing velocity; 1RM bench press. The study observed statistically significant increases in throwing velocity for the CKCRT group and also CKC training of the upper body is as effective as OKC training in promoting maximal strength gains. It has been suggested that the unique aspect of the rope-and-sling system of CKCRT allowed for progressive adjustments of exercise intensity and enhanced activation of the musculature involved in torso and shoulder stabilization, which led to improved segmental stability during throwing. The rope-and-sling equipment is inherently unstable, meaning that CKC subjects spent more time on the eccentric activity of a given exercise. It is possible that these additional eccentric stimuli played a role in throwing velocity improvements.

Soo-Yong Kim et al, in 2015 presents a new study concerning with effects of the Neurac technique in patients with acute-phase subacromial impingement syndrome (SIS). It is a first laboratory control study to observe the effects neurac therapy on shoulder pain, function and range of motion in patients with SIS. Neurac therapy has been used to restore muscle balance, improve muscular activation and joint stability. This study involved 13 participants diagnosed with shoulder impingement syndrome.

Three sessions of training has been conducted for four weeks using neurac technique. It involves four main exercises and all exercises were performed using Redcord Stimuli at 50 hz vibration. Exercise load has gradually increased. Three measures evaluated for observing improvement were pain level using VAS, shoulder function using SPADI and shoulder ROM by goniometer. Positive results were seen pain decrease significantly after the application of neurac method. It has been suggested that improvement is caused by increase in the scapulohumeral stability and subacromial space and enhance muscular activation of serratus anterior, lower trapz and rotator cuff. Wen-Dien Chang et al did a study in 2015 to examine the muscle activation of vastus medialis oblique and vastus lateralis in sling-based exercises in patients with patellofemoral pain syndrome. It was a cross-over study that evaluate the activity of the vastus medialis oblique (VMO) and vastus lateralis (VL) during sling-based exercises in patients with patellofemoral pain syndrome (PFPS) and compare the muscular activations in patients with PFPS among the sling-based exercises. The most important factor of PFPS is imbalance between VMO and VL, the VMO cannot antagonize VL that leads to patellar maltracking. Sixty participants diagnosed with PFPS with age range 20-25yr were recruited. Three sling based exercises, open and closed kinetic knee extension and hip adduction exercises were done by the participant in a random order, and electromyography was applied to record maximal voluntary contraction during the exercises. Positive significant difference were observed, VMO activations during the sling-based open and closed kinetic knee extension exercises were significantly improved than those during hip adduction exercises and also VMO: VL ratio for the sling-based closed kinetic knee extension and hip adduction exercises



approximated to 1. It was concluded that the sling-based closed kinetic knee extension exercise produced the highest VMO activation and also sling-based hip adduction exercises had beneficial effects on PFPS. It was suggested that the reason is that open kinetic chain extension exercise is not a functional intervention, because closed kinetic knee extension utilizes muscle cocontraction and proprioceptive reaction of multiple joint. Lam et al 2001 also reported that VMO training using open or closed kinetic chain exercise, effectively prevents and alleviates PFPS.

Conclusion

Neurac therapy is a newly developed method so there is a need for randomized controlled trials for different musculoskeletal disorders. It is clinically proved that this method of neuromuscular activation helps to regain normal function and normal muscular activating patterns. This method includes suspension that provides unstable surfaces to help in recruiting deep muscles. Suspension training provides alternative instability to the core, upper and lower limbs.

In spite of the wide use of suspension training system that are accessible and the expanding utilization of these techniques, there is an absence of evidence about the muscle action that might be affected by the different system.

It also involves vibration therapy, it has been reported that vibration has positive effects on enhancing motor function and improving energy metabolism and blood flow to the muscles. Still studies are needed to investigate the underlying mechanisms of sling exercise training, with and without different types of vibration.

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