Richmar®

WHITE PAPER

EMG PRO

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RICHMAR EMG PRO

INTRODUCTION:

The Richmar EMG PRO is a portable multifunction therapy device that includes four modalities in one hand-held device. The device has the capability to perform EMG (biofeedback), EMG triggered stim (ETS), neuromuscular electrical stimulation, and TENS. This portable therapy system is designed to treat weak inhibited muscles and/or hypertonic overactive muscles. The device allows for an active treatment approach to decrease pain, restore muscle performance, and neuromuscular control.

SURFACE ELECTROMYOGRAPHY (SEMG) BIOFEEDBACK

EMG biofeedback is a method of retraining muscle by the conversion of myoelectrical signals in the muscle into visual and auditory signals that provide immediate feedback to the patient[1]. It measures the level of muscle recruitment (μV) in the underlying muscle. Once a baseline level of muscle activation is captured the clinician can then set the threshold to a challenging, yet achievable level. The patient can then perform the exercise or functional tasks with the goal of reaching the threshold. In instances when a muscle is weak and inhibited the device can be set to "above threshold" so that the positive reinforcement for sufficiently recruiting the muscle is an audio signal when above the preset threshold. There is also a visual depiction of the threshold on a graph. This audio and visual feedback can enhance motor learning and motor control by creating a positive feedback loop. In instances where the muscle is overactive, and inhibition is the objective, the patient can be asked to keep the level of muscle activation below a predetermined threshold. Integrating surface EMG into training makes therapeutic exercise more interactive and focused. It also helps to ensure that the patient is activating the correct muscle rather than substituting with surrounding muscles. Once the threshold of muscle activation is consistently met, with good form, a new more challenging threshold can be set.

Unlike needle EMG, surface EMG (SEMG) uses surface electrodes to detect a change in skeletal muscle activity. This less invasive method is ideal for retraining muscle activation in the therapy setting. SEMG has been used in both musculoskeletal and neurological rehabilitation because of its role in increasing muscle activity in weak inhibited muscles and in facilitating a reduction in tone in hypertonic muscles.[1]

KNEE REHABILITATION

SEMG has been shown to be effective in retraining the quadriceps muscle in post operative patients that have undergone Anterior Cruciate Ligament (ACL) reconstruction or meniscectomy.[2,3] Quadriceps inhibition and weakness is one of the

largest impairments in the post-operative knee. The early addition of SEMG to establish increased recruitment during isometric quad setting exercises, as well as during more advanced open and closed chain exercises is advocated. SEMG can also improve the intensity and quality of the quadriceps training resulting in earlier normalization of gait and improved Lysholm Knee Scoring Scale scores.[3]

SEMG has been studied for treatment of patellofemoral pain with mixed results. Due to conflicting reports, it is generally agreed upon that additional research is necessary to determine if the addition of SEMG to standard care yields clinically meaningful differences in patient outcomes when treating patients with patellofemoral pain.[1]

STROKE

SEMG biofeedback has clinical usefulness in the treatment of patients with neurologic impairment. There is evidence to support the use of the use of SEMG to improve upper extremity function in patients recovering from stroke. Subjects receiving intensive SEMG biofeedback showed more significant upper extremity functional recovery than those who only received traditional rehabilitation therapy.[4] Patients with weak inhibited wrist and finger extensors show increased muscle activation and improve functional performance when SEMG is added to standard care.

SEMG biofeedback has also been shown to improve lower extremity function in patients with hemiplegia after stroke. Patients with weak inhibited dorsiflexion demonstrated improvement in gait after training with SEMG Biofeedback 5 days per week for 3 weeks. They demonstrated improved dorsiflexion range of motion, improved Modified Motor Assessment Scale scores, and improved Brunnstrom's neurophysiological assessment scores.[5]

In instances when the patient is only able to go through a partial portion of the range of motion, then EMG triggered electrical stimulation (ETS) may provide added benefit. In this instance the threshold is set for the necessary level of muscle recruitment to go through the patient's available volitional range of motion. Once the patient achieves this threshold of activation the electrical stimulation is triggered to assist them in completing the remaining portion of the range of motion.

INCONTINENCE

EMG biofeedback has been widely used clinically and in research trials for the treatment of incontinence. There are positive clinical reports from clinicians using this approach. However, research comparing basic pelvic floor training alone to biofeedback-mediated pelvic floor muscle training for women with urinary incontinence are conflicting. For example, Hagen et al[6] demonstrated no difference between pelvic floor muscle training with biofeedback and basic pelvic floor muscle training without biofeedback. The researchers did cite a limitation of their study was that women unable to contract their pelvic floor muscles were excluded from the study, when in fact biofeedback is often recommended in these instances. Further research in this area is warranted.

ADDITIONAL FEATURES BEYOND EMG AND ETS

In addition to the EMG based features of the device (EMG and EMG Triggered Stim), the device also features TENS and NMES. The EMG PRO allows for portable treatment in the clinic or can be issued to the patient for home use. For example, in post operative knee rehabilitation a patient would be able to manage their pain by using the TENS feature, improve neuromuscular control with the EMG and ETS features, and improve quadriceps strength recovery using the High Intensity NMES Strength Augmentation Protocol. The various therapeutic modality interventions can easily be integrated into the in-clinic and home exercise programs to increase effectiveness of the prescribed exercises.

TENS

Pain can inhibit muscle performance. Effectively managing pain with TENS can help to restore muscle recruitment and neuromuscular control. Combining TENS treatment with movement has been shown to me more effective than delivering TENS at rest.[7] Combining TENS with movement, functional activity, and therapeutic exercise interventions provides an approach that allows for the use of the modality in the context of function. The EMG PRO has 10 preset pain management clinical protocols as well as the ability to customize TENS parameters. The preset clinical protocols include Sensory TENS protocols for acute pain, Motor TENS protocols for Chronic pain, and Mixed frequency TENS as one of 6 anti-habituation protocols. The anti-habituation protocols can be helpful should the patient begin to habituate to traditional fixed frequency sensory or motor TENS parameters (e.g. they no longer receive the same amount of analgesia they once experienced).[8] The literature suggests that habituation can occur after a week of using the same stimulus,.[9] Rotating through the various anti-habituation protocols can be helpful when the patient reports not experiencing the previous level of analgesia they were accustomed to experiencing. It is also worth noting that intensity (mA) is one of the most critical parameters of TENS. Increasing the intensity when the patient accommodates to the stimulation is important.[8,9] As the intensity is titrated upward greater analgesia should be noted. If this does not help to overcome the habituation to a fixed set of parameters, then changing to mix frequency Tens or one of the other 5 anti-habituation protocols is recommended. The objective is to use the intensity and protocol that provides the best relief of symptoms.

NEUROMUSCULAR ELECTRICAL STIMULATION

The Richmar EMG PRO has 7 muscle training protocols including muscle re-education parameters, High Intensity NMES for Strength Augmentation for pre and post-op ACL reconstruction rehab, and pre and post-op total knee arthroplasty rehab.[10, 11] The device also allows for customizing parameters.

SUMMARY:

EMG biofeedback and EMG triggered electrical stimulation provide treatment options that can make exercise and functional training more effective. The patient receives immediate feedback on their performance and can be progressively challenged by increasing the biofeedback threshold. It also helps the patient to recruit the correct muscle rather than substituting with a neighboring muscle. The additional TENS and NMES features provide additional opportunities to manage pain and improve neuromuscular performance and strength.

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