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Abstracts

Functional electrical stimulation (FES) use in horses for musculoskeletal and neuromuscular rehabilitation

Sheila J. Schils

Equine Rehabilitation, EquiNew, LLC, River Falls, Wisconsin, United States

E-mail: sbSchils@EquiNew.com

Functional electrical stimulation (FES) has been used for over 15 years in equine rehabilitation and hundreds of case studies show the positive clinical outcomes of FES to reduce equine muscle spasms. FES is the most applicable electrotherapy for equine rehabilitation due to the ability of the device to stimulate deep enough to reach the skeletal support muscles of the horse while obtaining a high compliance. FES is also used for early mobilization after injury or surgery to obtain controlled, precise movement while the horse is confined. In addition FES has been used as a treatment for recurrent laryngeal neuropathy in horses. The goals of FES treatments for use in equine rehabilitation is to: 1. Reduce muscle spasms therefore reduce pain 2. Produce symmetrical muscle movement to improve skeletal alignment 3. Stimulate deep skeletal support muscles 4. Reeducate muscle memory to improve movement patterns 5. Strengthen muscle 6. Reduce muscle atrophy and 7. Recruit fast and slow twitch muscle fibers in all stages of rehabilitation. The fundamental purpose of the FES treatments in horses is to improve functional movement so that the horses are more comfortable and balanced, and therefore can perform better and have fewer chances of injury due to improved mechanics. The FES system used on horses has specific characteristics that may or may not be found in human FES systems. The signal must be produced by a microcontroller so that the clarity and control of the signal is precise. The stimulus must be able to reach comfortably 20cm deep to activate the deep core muscles of the horse. The system must be portable and must be able to be run off a battery so that no external source of electricity is needed. The FES system for horses weighs about 2 pounds and attaches to a surcingle, which is strapped around the thorax of the horse. The waveform is rectangular, with a zero net charge and the pulse duration is 250 microseconds positive/negative. Carbon electrodes are placed in a pad about 55cm long, which is used for treatments to the axial skeleton. Self-stick electrodes are placed on the neck and are also used for other site-specific applications. The typical voltage to produce strong muscle contractions, resulting in functional movement, along the top line of the horse and on the neck is approximately 7-9 volts. Treatment time varies from 20-35 minutes. Typically, 2 adjacent sites are treated on the same day, for example, the neck and thorax. A clinical change in the reduction of the severity of muscle spasms usually occurs after 2-4 FES treatments. Positive results utilizing this FES system and protocols have been obtained by a variety of veterinarians and equine physiotherapists. Functional electrical stimulation has produced encouraging rehabilitation outcomes in horses, however it is not extensively utilized in veterinary medicine. Equine case studies have shown examples of the use of FES to reverse muscle atrophy and decrease muscle spasticity. Exploring the application and outcomes of the use of FES for rehabilitation in horses may provide some interesting information for the utilization of FES in human rehabilitation.

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