Strength training induces adaptive changes in neuromuscular function that in turn contribute to the training induced increase in maximal contractile muscle force. The neuromuscular adaptation mechanisms has been examined by use of muscle electromyography (EMG) measurements, which recently have included single motor unit recording and measurements of evoked spinal reflex responses (H-reflex, V-wave). Elevated EMG amplitudes have been reported after strength training, which suggest an increased efferent neural drive to the muscle fibres.

Explosive muscle strength defined as the contractile Rate of Force Development (RFD), reflects the ability to generate steep increases in muscle force at the onset of contraction. Parallel increases in RFD, EMG amplitude and rate of EMG rise can be observed in the initial contraction phase (0-200 ms) following strength training. The specific neural adaptation mechanisms responsible for the training-induced increase in RFD include increased motoneuron firing frequency and an elevated incidence of doublet firing. A neural regulatory mechanism that limits the recruitment and/or discharge rate of motor units may exist during eccentric maximal voluntary contraction, as the EMG recorded in the muscle is markedly reduced. Notably, this suppression in neuromuscular activity is removed by strength training. The specific neural pathways responsible for this change remain unidentified. The increase in eccentric muscle strength observed with strength training may involve a down-regulation of spinal inhibitory interneuron activity mediated via Golgi organ Ib afferents. Furthermore, a training-induced reduction in presynaptic inhibition of la muscle spindle afferents would result in an elevated excitatory inflow to the spinal motoneurons, hence increasing eccentric muscle strength.

The Hoffmann (H) reflex reflects the level of motoneuron excitability and the magnitude of presynaptic inhibition of muscle spindle Ia afferents. The V-wave can be elicited when supramaximal stimulation of the peripheral nerve is superimposed onto voluntary muscle contraction. During maximal voluntary contraction (MVC), the V-wave and H-reflex may be used to quantify training-induced changes in spinal motoneuron output, motoneuron excitability and/or presynaptic inhibition.

Strength training results in elevated V-wave and H-reflex amplitudes during MVC, which could reflect enhanced neural drive in descending corticospinal pathways, elevated motoneuron excitability and/or reduced presynaptic inhibition of Ia afferents. In contrast, maximal M-wave amplitude remains unchanged after strength training. The H-reflex response recorded at rest does not seem to change with strength training. This finding suggests that the neural adaptive mechanisms induced by strength training involve physiological adjustments in spinal circuitry function rather than alterations in neuro-anatomy (i.e. changes in size or number of spinal motoneuron synapses).

Keywords: Muscle, Training, Neuromuscular System