Peripheral Nerve Responses to Muscle Stretching: A Systematic Review, Thomas, et al. *Journal of Sports Science and Medicine*, Volume 20, Issue 2, March 2021

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Level of Evidence: 3

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Stretching can help with neuromuscular adaptations such as increased muscle/tendon viscoelasticity, decrease motor neuron excitability, increase stretch/pain tolerance and reduce central/peripheral reflex activity. <u>The aim of this review is to evaluate if the mechanical tension of muscle stretching causes peripheral nerve responses.</u>
The study used PRISMA guidelines for systematic review, three online databases (Scopus, NLM Pubmed, ScienceDirect), and keywords "stretching", "nervous", "peripheral nerve", "nerve", and "spinal nerve" in various combinations. Only articles using English language were considered. A total 8,279 studies were identified and 10 pertinent articles were ultimately analyzed. The NIH Quality Assessment tool for Observational cohort and Cross-Sectional Studies was used with 4 good, 4 fair, and 2 poor.

<u>The variables identified among the 10 studies were</u> shear wave velocity (SWV, measuring <u>nerve stiffness</u>), <u>nerve displacement</u> (measuring distance between resting position and end point of a given movement), <u>pain pressure thresholds</u> (PPT), and <u>visual analogue scale</u> (VAS). PPT and VAS relate to pain and resistive torque, measuring pain onset. Stretches targeted the median nerve, sciatic nerve, tibial nerve, and posterior nerve cords. <u>The different protocols between studies included neural gliding, passive stretching, neural mobilization, nerve tensioning, neurodynamic tests, and nerve directed stretching.</u>

SWV (nerve stiffness) was measured with ultrasound elastography in 2 studies. One study found the stretching interventions decreased stiffness by 13.3% ± 7.9% in the sciatic nerve. The other study found stiffness decreased by 19.7% in the sciatic nerve and 13.7% in the tibial nerve.

Nerve displacement was measured via ultrasound scans of the sciatic, tibial, and median nerves. Displacements of 6.62 mm (sciatic, transversely), 3.78 mm (median, transversely), 5.22 mm (sciatic, longitudinally), and 4.28 mm (median, longitudinally) were found. <u>A deformation of the nerve was found in 14% of the sample population</u>.
Two different measures of pain were used, PPT and VAS. Stretching increased PPT from 18.9 ± 18.0 kg/cm2 to 20.8 ± 19.2 kg/cm2, and VAS was decreased from 4.2 ± 1.0 to 2.8 ± 0.9. One study used a neurodynamic test of the median nerve and found increased sensitivity to longitudinal stress and earlier pain onset compared to neutral position.

<u>Direct nerve elongation without rupture can be performed at approximately 6-20% of original nerve length, and nerve vascularization can be guaranteed up to 15.7% elongation.</u> Excessive nerve elongation can lead to a stretch lesion, which can cause pain, neuroma formation, neurological deficits, and incomplete return to function in 50% of cases with anelastic lesions leading to more severe outcomes than elastic lesions.

<u>The article considers possible hypotheses for why stretching decreases pain sensitivity or increases pain threshold:</u>

1. <u>stretching triggers post-synaptic inhibition mediated by muscle spindles,</u>
2. <u>stretching internodal distances greater than 11% begins to decrease and eventually stops nerve conduction, or</u>
3. <u>the nervi nervorum within peripheral nerve sheaths become more sensitive with compression (and so may become less sensitive with stretching)</u>

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