STRETCHING WITH VIBRATION IMPROVES FLEXIBILITY IN PATIENTS WITH PLANTAR FASCIITIS

[1]Elizabeth M. Russell, PhD and [1,2]Benjamin Thompson, MD

[1]The Andrews Research and Education Institute, Gulf Breeze, FL, USA
[2]Milton Hospital Orthopaedic Department, Milton, MA, USA
email: elizabeth.russell@gmail.com

INTRODUCTION

Stretching the triceps surae complex is the most common conservative treatment for patients dealing with plantar fasciitis pain [1]. Lengthening the triceps surae increases the ankle dorsiflexion range of motion and numerous previous reports have supported stretching to relieve plantar fasciitis pain. However, sometimes static stretching of the muscle cannot provide adequate relief. It is possible that adding vibration to the stretching routines in plantar fasciitis patients may increase ankle dorsiflexion range of motion more than stretching alone in patients with plantar fasciitis. Stretching with locally-applied vibration induces acute increases in flexibility [2,3], which may be beneficial for this population.

The purpose of this study was to determine how stretching with vibration applied under the foot affected ankle dorsiflexion flexibility in patients with plantar fasciitis. It was hypothesized that stretching with vibration would improve flexibility more than static stretching alone.

METHODS

Fifty-three (N=53) male and female patients with current clinical diagnosis of plantar fasciitis were recruited for this study. All patients used conservative therapies to treat their plantar fasciitis pain, such as stretching, ice, and rolling the arch of the foot. Subjects were randomly assigned to either a control group (N=27, mean age: 45.3 ± 13.3 yrs, height: 1.77 ± 0.1 m, body mass index: 29.1 ± 7.5 kg/m^2) who experienced no vibration or an experimental group (N=26, mean age: 49.5 ± 10.8 yrs, height: 1.67 ± 0.09 m, body mass index: 27.4 ± 4.8 kg/m^2) who stretched with vibration.

Prior to data collection, all subjects lay prone on an exam table while ankle dorsiflexion range of motion was recorded at 90 and 180 degrees of knee flexion. Marks were placed on the center of the lateral malleolus, along the line of the fibula and on the head of the fifth metatarsal. The center of a goniometer and the goniometer arms were aligned with these respective marks. Care was taken by the investigator to ensure that the subject's foot did not rotate out of plane when taking these measurements.

A vibrating platform (PowerPlate Pro5, 30 Hz) was used to deliver the vibration under the foot to the experimental group. Subjects were instructed to extend the knee of the affected foot and keep the heel flat on the platform while lunging forward to stretch the triceps surae complex to the point of initial discomfort. The unaffected, or less affected, foot was placed on a platform of equal height. The distance between the feet was not controlled and subjects were able to adjust this distance to gain the greatest stretch. Range of motion measures were repeated after the stretching bout using the same marks previously described.

Student's unpaired t-tests were used to determine significant differences between the two groups in terms of the change in ankle dorsiflexion range of motion from baseline measures ($p<0.05$). Effect sizes (d) were also calculated.

RESULTS AND DISCUSSION

Stretching the triceps surae complex with vibration under the foot resulted in a greater percent increase in ankle dorsiflexion flexibility than stretching with no vibration at both 90 degrees ($p=0.024$, $d=0.914$) and at 180 degrees ($p=0.014$, $d=0.707$) (Figure 1). This resulted in an absolute change of 0.7 ± 3.4

degrees in the control group and 2.7 ± 3.3 degrees in the experimental group.

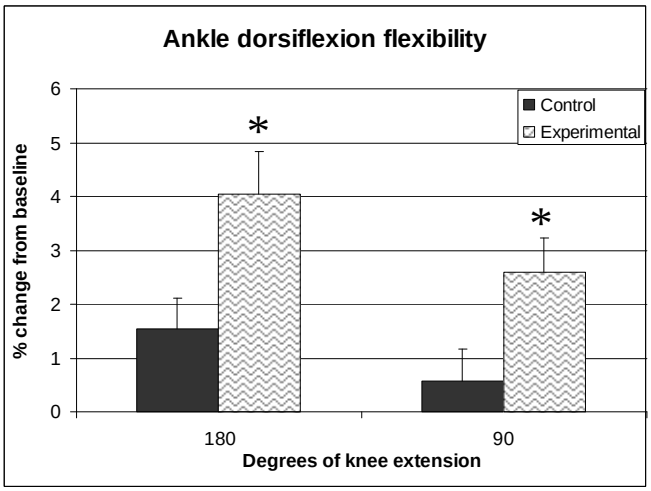

Figure 1: Mean percent change in ankle dorsiflexion flexibility during non-weight bearing and standard error bars.

There were no differences between groups for any of the subject characteristics of age, height, or body mass index.

In support of the hypothesis, stretching with vibration applied under the foot was a more effective way to increase flexibility in patients with plantar fasciitis than static stretching alone. Even though absolute and percent changes in range of motion were small, the moderate-to-high effect sizes indicate that these results may have a large degree of clinical relevance.

Therapy and conservative treatment for plantar fasciitis involves stretching, but previous research indicates that stretching alone may not be effective enough to adequately lengthen the triceps surae complex [4]. The use of vibration during stretching may augment flexibility. Feland et al. [5] reported that whole body vibration during stretching had long-term effects on flexibility retention in healthy populations. Therefore, it is possible that the positive effects of vibration during stretching may last longer than just the acute effect, however this has not been studied in a patient population with plantar fasciitis.

The positive effects of this therapy may result from three mechanisms: increased blood flow, increased pain threshold, or induced relaxation of the muscle. Vibration increases blood flow to the targeted area [6], which then increases temperature and has been linked to tissue extensibility [7]. The increase in flexibility may also be the result of decreased pain sensation from vibration [8] leading to the ability to stretch beyond initial discomfort. Lastly, vibration-induced flexibility may result from pre-synaptic inhibition of the Ia sensory fibers and the alpha motor neuron.

CONCLUSIONS

Patients with plantar fasciitis pain often need to stretch the triceps surae complex in the morning or throughout the day to relieve some of the tension on the plantar fascia during walking. Utilizing a form of vibration applied under the foot during their morning and daily stretching routines may enhance flexibility and improve mobility in this population. Future research will determine long-term successes of stretching with vibration on pain, function, and walking mechanics in patients with plantar fasciitis.

REFERENCES

1. Digiovanni et al., (2006) *J Bone Joint Surg Am*, **88**, 1775-81.
2. Issurin et al. (1994) *J Sports Sci*, **12**, 561-6.
3. Sands et al. (2006) *Med Sci Sports Exerc*, **38**, 720-5.
4. Grady and Saxena (1991) *J Foot Surg*, **30**, 465-9.
5. Feland et al. *Int J Sports Med*, **31**, 584-9.
6. Kerschan-Schindle et al., (2001) *Clin Physiol*, **21**, 377-82.
7. Lehmann et al. (1970) *Arch Phys Med Rehabil*, **51**, 481-7.
8. Staud et al. (2011) *Eur J Pain*, **15**, 836-42.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge Drs. Erik Nilssen and Joshua Hackel for assistance with subject diagnosis and recruitment, and Athletes' Performance, Inc. for use of the PowerPlate.