The human body is designed to adapt to motion. Below a mechanical strain threshold, muscles atrophy and bone is resorbed. Stressors that exceed the minimum strain threshold prompt growth on a muscle, bone, and even on a cellular level. An explosive recent growth in research on oscillatory mechanical pressure has proven vibration benefits physical therapy, improves post-surgical outcomes, increases benefits of athletic training, with short and long term benefits. High frequency vibration reduces the pain of training, injury, and even chronic conditions. When combined with cryotherapy, vibration can block even intense pain.

Vibration for Physical Therapy


Effect of illusory kinesthesia on hand function in patients with distal radius fractures: a quasi-randomized controlled study. Imai R, Osumi M et al. Clin Rehabil. 2017 May;31(5):696-701 “[Tendon vibration] was an effective post-surgery management strategy not only for pain alleviation, but also hand function...with improvements persisting for up to two months.”

Effects of local vibration and pulsed electromagnetic field (PEMF) on bone fracture: A comparative study. Bilgin HM Celik F et al. Bioelectromagnetics 2017 Jul;38(5):339-348 Three and a half hours of PEMF/day was less effective than 15 minutes vibration/day to increase osteogenic (bone) formation.

The acute effects of local vibration therapy on ankle sprain and hamstring strain injuries. Peer KS, Barkley JE, Knapp DM Phys Sports Med. 2009;37(4):31-38 “Local vibration for 10 minutes increased ankle dorsiflexion and eversion and hamstring flexibility (P < 0.03 for all), and significantly (P < or= 0.05) decreased perceived ankle and hamstring stiffness.”


Additional Resources:
• Effect of vibration treatment on symptoms associated with eccentric exercise-induced muscle damage. Lau W.Y., Nosaka K. (2011) American Journal of Physiology Medicine & Rehabilitation 90(Pt 8), 648-657

Vibration for Post-Surgical Rehabilitation


Local Muscle Vibration after ACL Repair Pamukoff DN et al Arch Phys Med Rehab 2016 Jul;97(7):1121-9 Increase in Central Activation Ratio (+2.7%, P=.001) and a reduction in quadriceps active motor threshold (-2.9%, P<.001) after LMV.
Improvement of stance control and muscle performance induced by focal muscle vibration in young-elderly women: a randomized controlled trial. Filippi GM, Brunetti O, Botti FM. Arch Phys Med Rehabil. 2009 Dec(12):2019-25. Sixty sedentary women had three 10-minute vibration sessions a day for 3 consecutive days applied to contracted or relaxed quadriceps, or received placebo (non-vibrated group). At 24 hours, the area of sway decreased by 20%, vertical jump increased by 55%, and leg power increased by 35%. These effects were maintained for at least 90 days.

Focal vibration of quadriceps muscle enhances leg power and decreases knee joint laxity in female volleyball players. Brunetti O, Botti FM et al. J Sports Med Phys Fitness. 2012 Dec;52(6):596-605. Eighteen volleyball athletes, (age=22.7 ± 3 years) were assigned to vibration on contracted or relaxed quads or sham vibration (NV). Combined contraction and vibration can significantly and persistently improve muscle performance and knee laxity in volleyball women players.


Low-level, high-frequency mechanical signals enhance musculoskeletal development of young women with low bone mass density (BMD). Gilsanz V, Wren TA, Sanchez M, Dorey F, Judex S, Rubin C. J Bone Miner Res. 2006;21(9):1464-1474. “Short bouts of extremely low-level mechanical signals, several orders of magnitude below that associated with vigorous exercise, increased bone and muscle mass in the weight-bearing skeleton of young adult females with low BMD.”

Additional Resources:

VIBRATION FOR MUSCLE STRENGTH, ATHLETIC TRAINING, DELAYED ONSET MUSCLE SORENESS


Effectiveness of using wearable vibration therapy to alleviate muscle soreness. Cochrane DJ. Eur J Appl Physiol 2017 Mar;117(3):510-509. Thirteen males used VT or nothing prior to eccentric arm exercises in a crossover trial separated by arms over 14 days. Acute and short-term VT significantly attenuated muscle soreness, creatine kinase and improved range of motion.

Intermediate Muscle Length and Tendon Vibration… Souron R. et al. Front Physiol. 2018 Sep 5;9:1226 Motor-evoked potentials more than doubled with vibration, with the best results applying vibration to the tendon at an intermediate muscle length. Vibration significantly increased knee extensor neuromuscular function.

To Compare the Effect of Vibration Therapy(VT) and Massage in Prevention of Delayed Onset Muscle Soreness (DOMS). Imtiyaz S, Vegar Z, Shareef MY. J Clin Diagn Res. 2014 Jan;8(1):133-6. Forty-five nonathletic women were randomized to 15 minutes of massage, 5 minutes of focal vibration, or no intervention prior to exercise. Vibration therapy and massage prevented DOMS equally versus control; only VT decreased 48h lactate dehydrogenase level.

Vibration Therapy in Management of Delayed Onset Muscle Soreness (DOMS). Vegar Z. Imtiyaz S. J Clin Diagn Res. 2014 Jun;8(6):LE01-4. “Vibration therapy improves muscular strength, power development, kinesthetic awareness, decreased muscle sore, increased range of motion, and increased blood flow under the skin. VT was effective for reduction of DOMS and regaining full ROM…and lower creatine kinase levels in the blood.”
Effects of vibratory stimulations on maximal voluntary isometric contraction from delayed onset muscle soreness. Koh HW, Cho SH et al. J Phys Ther Sci. 2013 Sep;25(9):1093-5. DOMS was induced in the musculus extensor carpi radialis longus of 60 adults. Ultrasound or vibratory stimulation for 10 minutes or control was used. Vibration had a positive effect on recovery of muscle function from DOMS compared to the control group, while ultrasound did not.


Additional Resources:


VIBRATION FOR PAIN RELIEF


Comparison of a vibration roller and nonvibration on knee pain and ROM. Cheatham SW J Sport Rehabil. 2018 Oct:1-7 Vibrating roller superior for knee pain relief and ROM to regular roller or sham P<.001.

A randomized, double-blinded, placebo-controlled clinical trial evaluating the effectiveness of daily vibration after arthroscopic rotator cuff repair. Lam PH, Hansen K, et al. Am J Sports Med 2015 43: 2774. Five minutes of vibration was applied daily after arthroscopic rotator cuff repair for 6 months. Vibration did provide acute pain relief at 6 weeks after surgery (visual analog scale [VAS] score, 2.24 (0.29 cm)) compared with placebo (VAS score, 3.67 (0.48 cm)) (P=.003).

Vibratory stimulation for the alleviation of chronic pain. Lundeberg T. Acta Physiol Scand Suppl. 1983;523:1-51 Seventy percent of 596 chronic pain patients reported reduction of pain with vibration; 100-150Hz were most effective, with subsequent cold enhancing duration of pain relief 12 hours or more.


Additional Resources:
COLD AND FOCAL VIBRATION FOR ACUTE PAIN IN ADULTS

**Influencing vaccinations: a buzzy approach to ease discomfort randomized controlled trial.** Redfern RE et al. Pain Manag Nurs. 2018 Nov 10. In 497 adults, ice wings and 180Hz vibration reduced pain (0.87 v. 1.12, p=.035) and gave a better than previous vaccination experience (62% vs. 23.9%, p<.0001).

**Effect of buzzy on pain and injection satisfaction in adult patients receiving IM [diclofenac] injections.** Sahin M. Pain Manag Nurs. 2018 Dec;19(6):645-651. In 65 adults, ice wings and 180Hz vibration reduced pain (4.67 +/- 4.94 v. 17.69 +/- 9.85 p=.000) and increased satisfaction (94.82 v. 85.06, P<.0001).


FOCAL CRYOTHERAPY FOR PAIN


CRYOTHERAPY FOR RECOVERY


**Comparison of the effects of pressurized salt ice packs with water ice packs on patients following total knee arthroplasty.** Liying Pan et al Int J Clin Exp Med 2015;8(10):18179-18184 A compressing pack with -18 degree C cold worked better than standard ice and water for pain and swelling.

**Time-course of changes in inflammatory response after whole-body cryotherapy multi exposures following severe exercise.** Pournot H. et al. PLoS One. 2011;6(7):e22748. IL-1b (Post 1 h) and CRP (Post 24 h) levels decreased and IL-1ra (Post 1 h) increased following cryotherapy, supporting the decrease in pro-inflammatory cytokines activity, and increase in anti-inflammatory cytokines.

WHY VIBRATION AND CRYOTHERAPY TOGETHER

Cryotherapy reduces inflammation but also persistently reduces blood flow. Vibration vasodilates, cancelling the vasoconstriction effect while adding pain relief and separating muscle fibers to reduce stiffness. An increased number of residual cross-bridges between myosin heads and actin is thought to largely contribute to this exercise-induced increased stiffness (Proske and Morgan, 2001) which vibration addresses.

WHY VIBRATION INSTEAD OF ELECTROSTIMULATION

Electrostimulation does not increase blood flow, because it is the pulsatile vibration that mimics rapid heart rate, releasing nitric oxide and vasodilating. Electrostim does not cause muscle twitching in the amplitude and frequency that actual motion does. (J Athl Train. 2012 Sep-Oct;47(5):498-506.)

High frequency vibration, but not electrostim, improved physical function and reverses hypotrophy of quads. (Int J Rehabil Res. 2017 Jul 18) This is probably because electrostim does not promote hormonal repair gene expression.