

# Crossover Trial of Novel Mechanical Oscillatory Vibration Frequency Device Versus TENS for Musculoskeletal Pain

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**Objective**  
To evaluate whether high frequency mechanical vibration in the Pacinian stimulation range (180-250Hz) relieves pain more than electrical stimulation

**Design**  
**Randomized non-blinded crossover trial**

**Setting**  
Outpatient physical therapy

**Participants**  
13 females and 7 males aged 25 – 81 receiving physical therapy for OA (6), sacroiliac dysfunction (2), shoulder injury (5), post-surgery (3), epicondylitis (1), plantar fasciitis (1), fibromyalgia (1), and bone cancer of the spine (1).

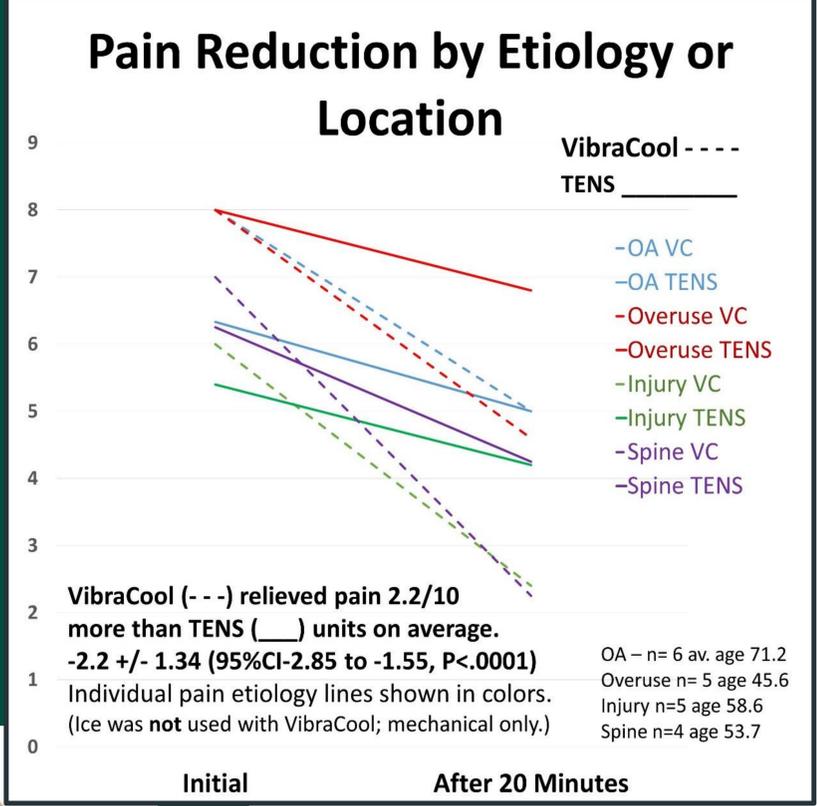
**Interventions**  
Consented patients got a randomized 20-minute session of 180-200Hz mechanical oscillatory vibration, 0.1m/s<sup>2</sup> amplitude (VibraCool (VC), Pain Care Labs, Atlanta, GA) or a generic model-TENS 3000 applied to pain. TENS units used 150Hz frequency with a pulse width of 200ms, asymmetrical biphasic square pulse waveform, and amplitude as high as comfortable on a 0-80mA using a 500 ohm load per channel. Most patients tried the devices on different days. On 2 occasions when TENS was applied with no relief VC was used the same day.

**Main Outcome Measures**  
Visual analog scale (VAS) pre- and post-therapy pain scores (from 0 "no pain" to 10).

**Results**  
Mean pain relief with VC high frequency vibration was 3.60 +/- 1.60 (95%CI 2.85 to 4.35). Pain relief with TENS was 1.40 +/- 1.05 (95%CI 0.91 to 1.89), with a mean difference of -2.2 +/- 1.34 (95%CI -2.85 to -1.55, P<.0001). Pain relief with VC was greatest for spine, injury and post-surgical pain (5-6) and least for OA (2-3). One patient had no relief with VC (plantar fasciitis); five patients had no relief with TENS (plantar fasciitis, OAx2, shoulder arthralgia, and s/p ORIF).

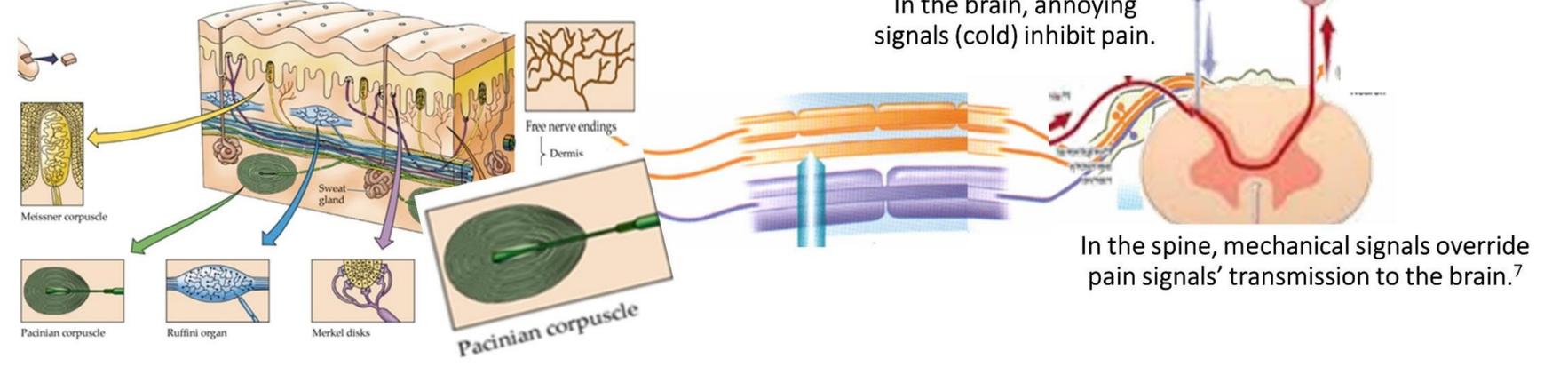
**Conclusions**  
**Mechanical high frequency vibration in the Pacinian corpuscle frequency was superior to electrical stimulation for pain relief, with highest efficacy for injury, post-surgical and spinal conditions.**

# Wearable mechanical stimulation frequency relieved overuse and spine pain 4x better than TENS.



## Why Mechanical Stimulation > Electrical Gate Control Pain Relief

Mechanoreceptors fire at different mechanical frequency thresholds. Pacinian (180-250Hz)<sup>1</sup> block pain most.<sup>2</sup>



TENS uses electricity (2-5Hz & 80-150Hz) to twitch skin to make motion to fire nerves.<sup>3</sup>  
50% of patients tolerate the electricity amplitude needed to fire deep Pacinian.<sup>4</sup>  
100% of patients tolerate mechanical amplitude to fire Pacinian mechanoreceptors.<sup>5</sup>  
Mechanical waves stretch (firing Ruffini) + decay to trigger slower (Meissner) Hz.<sup>6</sup>

## References

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