A Novel Circulation Enhancing Sleeve

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Problem Statement

Psychogenic numbness affects over 20% of adolescents, disrupting writing and school concentration. Existing manual remedies are slow and high-effort.

Device Development Goal

The goal is to create a device that can **increase blood circulation** by **utilizing of vibration therapy**. With our device, the client will be able to **recover from numbness** and regain mobility of his arm.

Criteria:	Ranking
Functional:	
Return mobility to arm during episodes (L1)	10
Return function to arm in <15 min (L1)	10
Does not heat up excessively during use (L1)	10
Allows full range of motion for the arm when not in episode (L2)	8
Addresses psychogenic effects (L2)	5
Targets pressure points (L3)	3
Physical:	
Portable to move device around easily (L2)	7
Adjustable to fit different clients' arm (L3)	3
Quiet when functioning (L3)	6
Comfortable for extended periods of wear (L3)	6
Able to be cleaned (L3)	4
Cost:	
Under $50 to produce (L2)	6
User:	
Able to use hand to maneuver during episode (L1)	7
Documentation:	
Manual/guide on how to safely use the device (L3)	6
Logbook for device creation is present (L3)	6

Past Prototypes

Figure 1: *Vibration Sleeve Design.* Cons: The fabric was bulky and caused sweating.

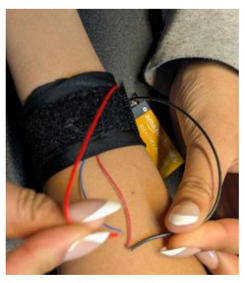

Figure 2: *Targeted Nerve Bracelet.* Cons: Doesn't target the whole arm.

Figure 3: *Dowel Sleeve Design.* Cons: The compression was not as effective as the vibration.

Methods

Wrist wraparound:

1. Cut 2 fabric pieces (wrist-to-forearm length × min. circumference + 2 in.); sew 3-sided pockets for battery and motors onto one piece
2. Layer second piece on top and sew the perimeter to seal; attach rough Velcro (~2 in.) on one end and smooth Velcro (~min. circumference) on the other

Middle pad:

1. Cut a 1.5 in. wide strip (mid-wraparound to below finger joints) and sew it to the right side of the wraparound
2. Cut a 0.5 in. wide strip long enough to wrap under the finger joints; sew its midpoint to the palm pad and attach Velcro to each end (rough side up, smooth side down)
3. Sew 3-sided pockets for wiring and motors onto a fabric piece, then seal with a second layer sewn around the perimeter

Our Design

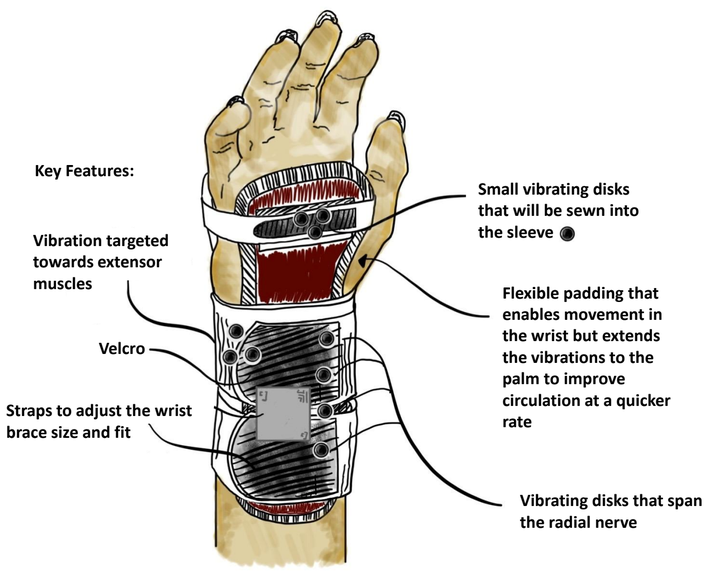

Figure 4: *Final Full Vibration Sleeve Sketch.* Details key features and visual representation.

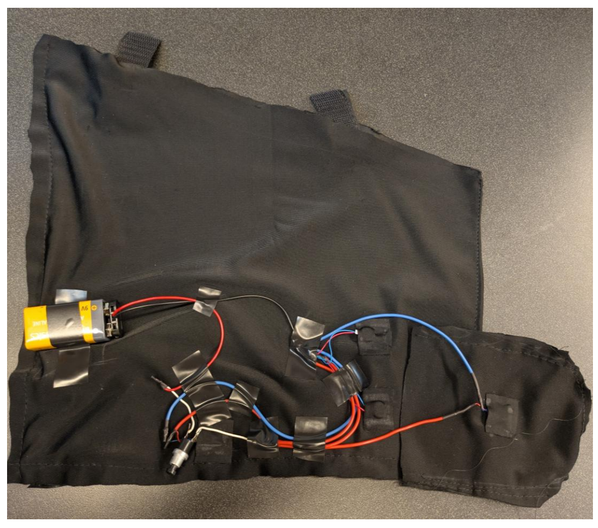

Figure 5: *Final Full Vibration Sleeve Internal Image.* Shows wiring, battery, vibration motors, and hand and palm sleeves.

Figure 6: *Final Full Vibration Sleeve Front Image.* Shows the front view of the sleeve while on an arm.

Design Studies

Temperature of Device Over Time

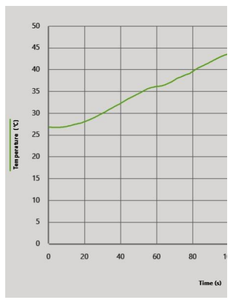

Figure 7: *Temperature of Device Over Time.* Temperature increase of one vibration motor over 3 cycles of 15 seconds of vibration and 10 seconds of cooldown. The graph follows a linear progression by equation y=0.06374x+27.16. The total increase in temperature was 5 degrees Celsius, showing that our device does not drastically increase in temperature.

Arm Weakness of Client Over Time

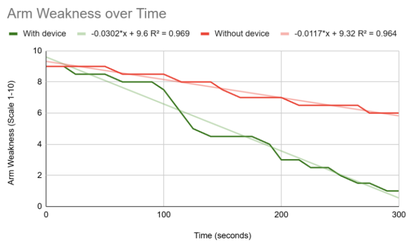

Figure 8: *Arm Weakness of Client Over Time.* The client rated the numbness of his arm during an episode on a scale of 1-10, once with the device, and once without. The data with the device follows a linear progression by equation y= -0.0302x+9.6. The devices reduces the client's arm's numbness from 9/10 to 1/10 within 300 seconds. Without the device, the client's arm's numbness decreases from 9/10 to 6/10 within 300 seconds.

Competitors

Figure 9: *Insight Timer Competitor.* A meditation app that helps the mental aspect of the psychogenic aspect of paresthesia.

Figure 10: *TouchPoint Wristband Competitor.* Tracks heartbeat and other physical identifiers to identify an episode.

Figure 11: *Compression Sleeve Competitor.* General athletic compression sleeve that improves blood flow.

Conclusions

A vibration sleeve can effectively help reduce hemovisualization-related psychogenic paresthesia in Client S when compared to waiting for weakness to reduce over time.

Future Work

- Auditory cue to initiate vibration
- EMGs to trigger vibration
- Slimmer design
- Adaptable for multiple arm locations (forearm, upper arm, shoulder

Citations

Be Visible Sports. (n.d.). *Arm compression sleeves — black*. Be Visible Sports. https://www.bevisiblesports.com/products/arm-compression-sleeves-black

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Insight Network Inc. (2026). *Insight Timer–Meditate, Sleep* (Version 15.0) [Mobile app]. Apple App Store. https://apps.apple.com/ai/app/insight-timer-meditate-sleep/id337472899

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