USING 3-DIMENSIONAL MOTION ANALYSIS TO EVALUATE THE EFFECTS OF A NOVEL, WEARABLE CORRECTIVE TRAINING DEVICE ON BIOMECHANICAL MOBILITY, STABILITY, ASYMMETRY, AND VULNERABILITY TO MUSCULOSKELETAL INJURY

HUNGATE, JOEL A
A Vice President of Orthopedic Programs, EMBA, Biomedical Engineer, Scientific Analytics/DARI Motion, Overland Park, KS, USA

Chris Tedesco CEO/Inventor USMC Veteran

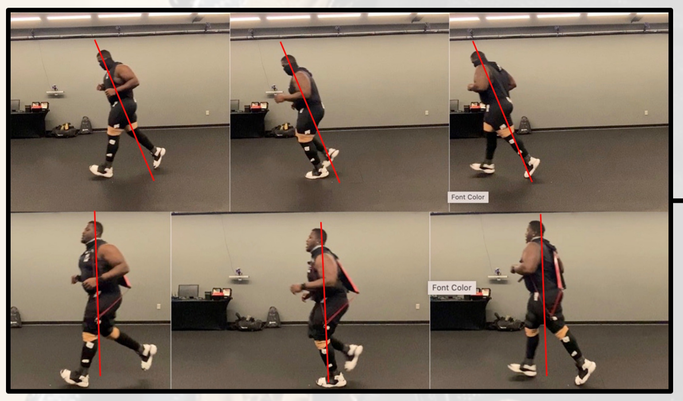
The Neuropak is a wearable, user-defined corrective training device that applies continuous calibrated resistance to the user's body in order to accelerate critical skills-based training and conditioning. The NeuroPak produces an immediate potentiation effect on user biomechanics relevant to improving warfighter physical performance, injury prevention, skills-based learning and resiliency. Utilizing a human-centered approach, the NeuroPak intuitively increases neuromuscular activation, AMPLIFIES motor learning and maximizes mechanical performance across all movement patterns — ultimately improving resiliency, readiness and operational performance. Whether completing tactical, technical or logistical tasks, **the NeuroPak accelerates critical skill-based proficiencies while improving biomechanics — resulting in more efficient training in less time, improving performance and *significantly reducing the risk of injury***.

When measured in a previous study utilizing an FDA-approved and DoD-validated motion analysis system, the NeuroPak proved to increase mobility, stability and performance, reduce vulnerability to injury by 30.25% and reduce asymmetries by 58% after just one use.

Problem:
There is a disconnect between skill development and traditional strength and conditioning.

Human movement training has not changed in decades—athletes train in the gym, or people undergo therapy in clinical settings, and then try to translate those efforts into the authentic environment of the court, field, work, or life.

Unfortunately, these traditional approaches and rehabilitation methods cannot replicate the skill-based competencies required for live competition or activities of daily living because they do not equally engage the body and neurological responses. The concept of unequal engagement of neurological response has burdened efforts applied in performance, military, wellness, and rehabilitation/healthcare.
traditional equipment and methods.



Subject is a 305lbs Division 1 defensive lineman.
Prisma Labs Columbia, SC
Dr. Jay Patel
Protocol: Baseline-NeuroPak Gait
Method: Noraxon marker-based motion analysis

Abstract:
We hypothesize that the device produces a potentiation effect on user biomechanics relevant to improving warfighter physical performance and longevity. As such, this study analyzes the biomechanical effects of the Neuropak in a test-retest evaluation using a validated marker-less motion analysis system.
Methods: A standardized movement protocol was performed sequentially (baseline, Neuropak, Retest) in the DARI Motion marker-less motion capture system (Scientific Analytics Inc., Overland Park, KS) to compare baseline measures to potentiation effect at retest. The subject was a trained collegiate athlete and the motion protocol consisted of 15 dynamic movements. Kinematic and kinetic data analyzed consisted of 142 unique datapoints per session, measuring primary plane mobility, secondary planar deviations, kinematic and kinetic asymmetry, performance metrics, and aggregate scoring. The inter-session changes in these datapoints were calculated in unit-change and as percent-change from baseline.

Results:
Primary plane improvements were found overall at the shoulders (6.94%), spine (22.18%), hips (0.79%), knees (4.43%), and ankles (7.91%).
Reductions in secondary planar deviations were found in the spine (-5.94%), and knees (-0.17%), while increases in secondary planar deviation were noted in the shoulders (39.02%), hips (11.52%), and ankles (47.92%)
Reductions in asymmetry at the joint level were found in the shoulders (-35.77%), spine (-36.74%), and knees (-0.17%), while increases in asymmetry were noted at the hips (40.81%) and ankles (78.15%).
Performance improved by 8.23% on average, with average increase of 0.87 inches to squat depths and jump heights.
Conclusions: 67 of 142 datapoints exhibited improvement relative to baseline, and Neuropak produced on average a 30.25% improvement in mobility, performance, stability, and global quality scores.

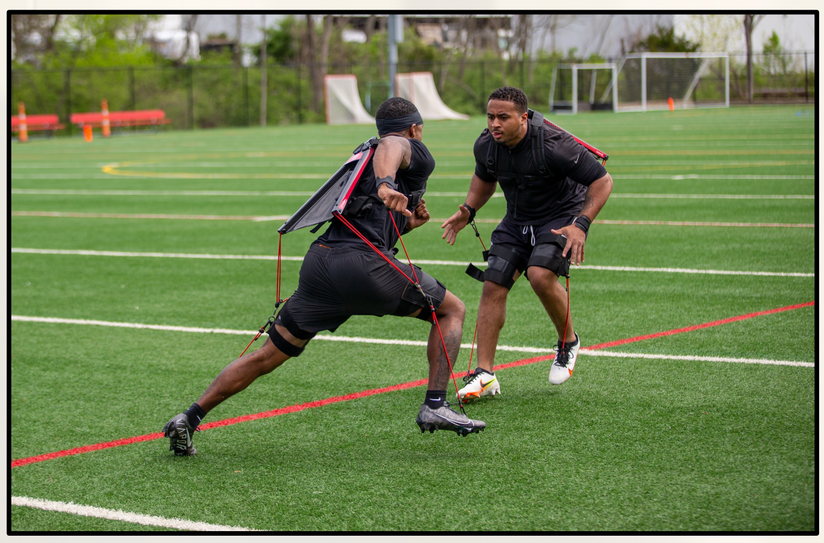
Research Partners:

CONTRACT #FA864922P0091 **STTR PI** – OPTIMIZING The Human Machine
CONTRACT #FA864922P0089 **STTR PI** - OPTIMIZING WARFIGHTER PERFORMANCE
CONTRACT #FA864922P1144 **STTR PII -** Reducing Air Force Rate of Non-Contact Injury and Rehabilitation Time Post injury Through Implementation of the NeuroPak Training System
CONTRACT #FA864922P1151 **STTR PII** OPTIMIZING Job Related Training and Performance, Decreasing the Risks of Musculoskeletal Injury, and Management of Chronic Pain through implementation of the NeuroPak Training System
TOPIC NUMBER: #AF221-DCSO1 **SBIR Direct to Phase II** Reducing Air Force Rate of Non-Contact Injury and Rehabilitation Time Post injury Through Implementation of the NeuroPak Training System

The Solution
The Neuropak increases the activation of the neuromuscular response associated with any skills-based activity via applying continuous, calibrated bi-lateral resistance to the user's limbs in a novel, robust, and user-defined manner. The application of this resistance improves proprioception and neuromuscular adaptation, stabilizes and conditions muscle groups to improve movement quality and reduce injury risk. The Neuropak method provides an efficient, effective, and user-friendly approach to human performance, rehabilitation, or injury prevention: Simply wear the device, and move better.

This approach improves motor learning without constraining the activity itself or preventing the execution of smooth, natural movement. The ability to "train how you play/fight/work/live" for athletes, military personnel, workers, those trying to recover from injury or disease, or anyone just living their daily lives, will fundamentally shift the paradigm of training, recovery, and healthy human movement in general.

The benefits of the Neuropak are not just limited to the military and have been introduced to other markets dependent upon human motion health, rehabilitation, and performance. The creation of the Neuropak Training System is the first solution that **bridges the gap between functional skill-specific performance training and corrective exercise (injury rehab/prevention)** as a single comprehensive platform. This unrestricted training system improves performance in authentic training environments, improving the quality of movement, reducing the risk of injury, and offering a simple yet robust tool that quickly and effectively helps any user move better.



This image illustrates the the dynamic and constant load at every joint level and the ability to train at full speed with specificity

Scan to access more detailed research and videos

SCAN ME

References:
1.Hungate, Joel, Using 3-Dimensional Motion Analysis to Evaluate the immediate effects of a novel, wearable corrective training device on Biomechanical mobility, stability, asymmetry, and vulnerability to Musculoskeletal injury, DARI Motion Internal Validation, 2018
2.Mosier et al, Movement Analysis via Motion Capture System Helps Identify Injury in At-Risk NCAA D1 Football Players—A Preliminary Study, NSCA, Indianapolis, 2018
3.CMSgt Joshua Smith, USAF BA Prep Superintendent Lackland JBSA: Integration of Technology into the Daily Training of a Battlefield Airman Candidate, TSAC, April, 2018 Norfolk, VA.
4.Moodie, Patrick, Internal DARI Motion Reproducibility Master Validation, Data on file with FDA 510k Submission
5.Zhu L, Sulsky SI, Bulzacchelli MT, Hill OT, Kardouni JR. "Risk factors for training-related injuries during U.S. Army basic combat training." Oral presentation, Military Health System Research Symposium. August 15-18, 2016. Orlando/Kissimmee, FL.
6.Sulsky SI, Bulzacchelli MT, Zhu L Kardouni JR, Hill OT. "For want of a nail: Incomplete data and missing documentation in administrative data hamper medical research." Poster presented at the Military Health System Research Symposium. August 15-18, 2016. Orlando/Kissimmee, FL.
7.Knapik, JJ, Canham-Chervak M, et al. Discharges during U.S. Army basic training: injury rates and risk factors. Mil Med, 2001;166(7):641-7.

www.1109bravo.com

APPROVED FOR PUBLIC RELEASE