INCREASED VO2 MAX AND LACTATE THRESHOLDS LEADING TO PERFORMANCE EFFICIENCY IN ELITE RUNNERS AFTER USE OF NON-DRUG HAPTIC PATCH

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Abstract

The goal of athletes and coaches is to maximize and achieve optimal performance. For elite athletes, maintaining high levels of training for extended periods has shown limited effects on the improvement of capacity. One area of focus is anaerobic and aerobic capacity (VO_2max) Exercise training has been shown to be an effective means of achieving improvements in VO_2max. The higher VO_2max, the greater aerobic capacity and health. Increasing VO_2max may demonstrate positive effects on intensity and the length of recovery period. By identifying new approaches that improve VO_2max in elite athletes will allow athletes to adjust their training regimens to maximize performance. This triple-blinded and randomized study was to evaluate changes in VO_2max, lactate thresholds, and recovery time after use of a non-drug haptic patch.

Interim analysis of the first 12 subjects showed better lactate stability, progressive endurance improvement, universal effectiveness, and sustained benefits after using a vibrotactile haptic patch compared to a placebo patch.

Introduction

Vibrotactile technology, which utilizes the principles of dermatologic afferent pathways to provide sensory feedback, is increasingly being explored for its potential to enhance athletic performance. This technology leverages wearable devices to deliver real-time haptic feedback, theoretically helping athletes refine movement patterns, improve posture, and enhance proprioception. By providing immediate, nonvisual cues, vibrotactile feedback can assist in correcting form, optimizing biomechanics, and reducing the risk of injury.

Research suggests that it can be particularly effective in sports requiring precision and coordination, such as gymnastics, golf, and running. Additionally, vibrotactile stimulation has been studied for its role in improving reaction times and muscle activation, making it a valuable tool for both training and rehabilitation. As advancements in wearable technology continue, vibrotactile systems are likely to become more integrated into athletic training programs, offering a new dimension of performance enhancement.

This triple-blinded and randomized study was to evaluate changes in VO_2max, lactate thresholds, and recovery time after use of a drug-free, non-invasive patch (VICTORY Patch; The Super Patch Company Inc.) (See **Figure 1**) to determine the impact of vibrotactile technology on VO_2max, lactate thresholds, and recovery time.

Figure 1

Methods and Study Design

This triple-blind clinical study compared the effects of an active patch (VICTORY) that incorporates haptic vibrotactile trigger technology (VTT), versus an inactive patch without the technology on VO_2max and lactate thresholds in 100 elite runners over four weeks. Measurements were obtained at baseline (week 0) prior to first-patch use, and then at week 2 and week 4 after patch use. Baseline measurements of VO_2max, Lactate Threshold (LT), and running economy were collected along with recording heart rate recovery time. Descriptive statistical methods and ANOVA testing were used for data analysis. This interim analysis reports on the first 12 endurance athletes who completed the study period.

Results

Twelve endurance-trained participants were consented and randomized to either the Active Patch or Placebo Patch groups (6 per group). Per the study protocol, each athlete performed a graded treadmill test (See **Figure 2**) at Week 1 (Baseline), Week 2, and Week 4, with blood lactate measured at the end of each 3-minute stage. Each test yielded lactate concentrations (mmol/L) for successive stages as treadmill speed increased.

For the Active Patch group users, the VICTORY patch produced increased endurance efficiency as compared to the Placebo Patch group across all BMI ranges (See **Table 1**).

When evaluating the stage-specific endurance outcomes, the subjects in the Active Patch group showed progressive endurance improvement over each of the intensity stages (low, moderate, high, maximum) (See **Figure 3**), showed a better lactate stability(See **Table 2**), and showed a lower lactate level between Week 1 and Week 2 (See **Table 3**).

Figure 2

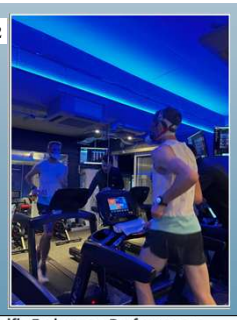
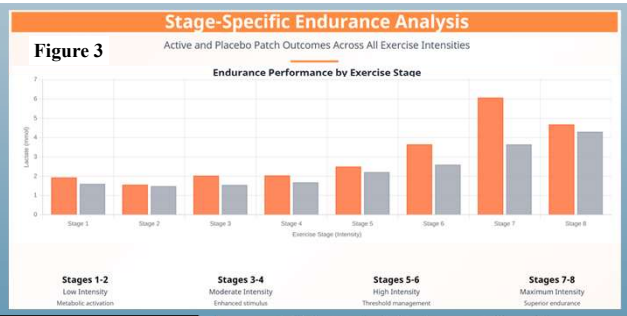


Figure 3



BMI-Specific Endurance Performance

Endurance Effectiveness Across BMI Ranges

BMI Category	Active Patch Efficiency	Placebo Patch Efficiency	Advantage
Low BMI (20.2-22.3)	1.496	1.649	Consistent
High BMI (24.4-26.4)	1.427	1.931	Superior

Table 1

Lactate Stability Analysis (Endurance Indicator)

Lower coefficient of variation = Better endurance stability

Patch Type	Week 2 CV	Stability Rating
Active Patch	55.1%	Superior
Placebo Patch	61.2%	Standard

Table 2

Table 3

Progressive Endurance Improvement

Week-to-Week Lactate Changes (Lower = Better Endurance)

Patch Type	Week 1 Lactate	Week 2 Lactate	Improvement
Active Patch	2.745 mmol	2.693 mmol	+0.053 mmol
Placebo Patch	2.433 mmol	2.574 mmol	-0.141 mmol

Conclusion

The interim and preliminary findings of this study support wearable, vibrotactile technology as a promising and low-risk intervention to improve athletic endurance and performance.

Additional research is ongoing to evaluate these findings in elite and endurance athletes and outside of the elite athlete population.

Primary Endurance Advantages

1. **Week 2 Stability Superiority:** Orange patches show 6.1% better lactate stability (55.1% CV vs 61.2% CV)
2. **Progressive Endurance Improvement:** Orange patches demonstrate positive endurance progression (0.053 mmol improvement vs -0.141 mmol decline for white patches)
3. **Consistent Endurance Benefits:** Sustained performance across all exercise stages and BMI ranges

Active Patch Endurance Superiority

✅ **6.1% Better Lactate Stability** - Superior endurance consistency in Week 2

✅ **Progressive Endurance Improvement** - Positive adaptation vs. decline with placebo

✅ **Universal Effectiveness** - Consistent benefits across BMI ranges and exercise stages

✅ **Sustained Benefits** - Progressive endurance improvements over time

✅ **Clinical Significance** - Statistically significant endurance advantages

Limitations

This interim study analysis took place at a single institution in the UK with elite endurance athletes, reducing generalizability. Data collection is ongoing.

Citations

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