

Case Study: Using Healables[®] ElectroGear[®] Wearable E-Textile Sleeve with Embedded Microcurrent Electrodes and WelMetrix[®] Physiologic Motion Sensors to Enhance and Monitor the Sporting Performance of a Baseball Pitcher [†]

Moshe Lebowitz, George H. Lowell, Michael April, Ziv Ritchie, Marco van der Putten Landau and Moshe Ehrenberg *

Healables, Ltd., Jerusalem 97298, Israel; mlebowitz@healables.io (M.L.); ghlowell@healables.io (G.H.L.); docapril@msn.com (M.A.); zritchier@healables.io (Z.R.); mlandau@healables.io (M.v.d.P.L.)

* Correspondence: mehrenberg@healables.io; Tel.: +972-52-758-3377

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Abstract: We aimed to reduce the recovery time for baseball pitchers from the established recovery period of four days to only one day. We designed a wearable and flexible arm sleeve composed of knitted nylon and a polyether–polyurea copolymer that has embedded proprietary dry electrodes that deliver a personalized microcurrent electron stream regimen as well as physiological motion sensors that provide real-time feedback for this electroceutical's efficacy, positioning it as a revolutionary e-textile for enhancing and gauging sporting proficiency. Healables[®] (Jerusalem, Israel) developed a noninvasive wearable device that docks onto its adjustable e-textile for team training and on-the-go and home-based improvement in terms of sports readiness, recovery, and performance.



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1. Introduction

As to our case study, we were aspiring to expedite baseball game readiness for baseball pitchers in terms of advancing muscle recovery time, performance quality, and both mental and physical agility [1]. The incentive for developing our innovative knitted e-textile with embedded dry electrodes was to provide a reliable, user-friendly alternative to the commonly utilized adhesive and skin-irritating electrode pads in order to facilitate the most efficacious and comfortable administration route for a topical microcurrent regimen.

2. Materials and Methods

In our case study of shoulder strength enhancement in a baseball pitcher, our specially designed wearable, stretchable, and flexible arm sleeve was composed of knitted nylon and a polyether–polyurea copolymer that has embedded proprietary dry non-abrasive and non-sticky microcurrent electrodes, a WelMetrix[®] (Rockville, MD, USA) physiologic motion sensor, and built-in proprietary elastic stretchable conductive pathways (Figure 1).

The innovative, portable, miniature, lightweight, flexible, and wearable ElectroGear[®] electron stream microcurrent device docks via snaps to our e-textile for topical delivery without wires and is operated by smartphone and an AI-enabled app with an interactive health coach. The device's digital operation can transmit data to a health or sports professional portal to remotely monitor and adjust progress and has CE certification in the EU for sports recovery.



Figure 1. Blue arrow points to ElectroGear® Electron Stream® (Colchester, UK) device docked on e-textile sleeve with embedded proprietary dry microcurrent electrodes (yellow circles) and stretchable conductive pathways (grey tracks).

The pitching strength was measured by a WelMetrix® Wireless Motion Sensor before and after using the ElectroGear® Device. This motion sensor uses proprietary signal processing and AI algorithms to collect data on arm or leg motion and track the range of motion of joints of the upper and lower extremities and spine. More specifically, this sensor measures muscular angular velocity (degrees/s or “deg/s”), which refers to the rate that an object rotates about an axis [2]. In our case study of a baseball pitcher, the sensor evaluated the upper arm angular velocity of the shoulder external rotation with the shoulder at 90° of abduction. The measured angular velocity is directly proportional to the muscular strength, as a faster upper arm angular velocity reflects increased pitching strength. Finally, the WelMetrix® Wireless Motion Sensor also measures balance and core strength.

We used the WelMetrix® Motion Sensor to document arm strength in our case study, with and without our baseball pitcher using the ElectroGear® Device, by measuring the angular velocity of shoulder external rotation with shoulder abduction at 90 degrees. We wanted to investigate whether the use of the ElectroGear® Device achieved a more rapid restoration of pitching arm strength for our baseball pitcher, in association with an optimal enhanced recovery time needed for upcoming game availability.

3. Results

As a successful result of Healables® ElectroGear® microcurrent application via the Healables® ElectroGear® device, the shoulder strength angular velocity metric assessed via the WelMetrix® e-textile sensor, one day later, revealed a significant pre-game improvement from 1066 degrees/s to 1239 degrees/s, a 16% increase versus 900 degrees/s, a 16% decrease from 1066 degrees/s, in the absence of the Healables® device (Figure 2). The actual comparative percentage strength gain after 24 h, obtained by directly calculating the precise disparity between the result of topical microcurrent application via our ElectroGear® device (1239 deg/s) versus no ElectroGear® device treatment (900 deg/s), was a significant 38% enhancement in the differential of baseball pitching arm strength.

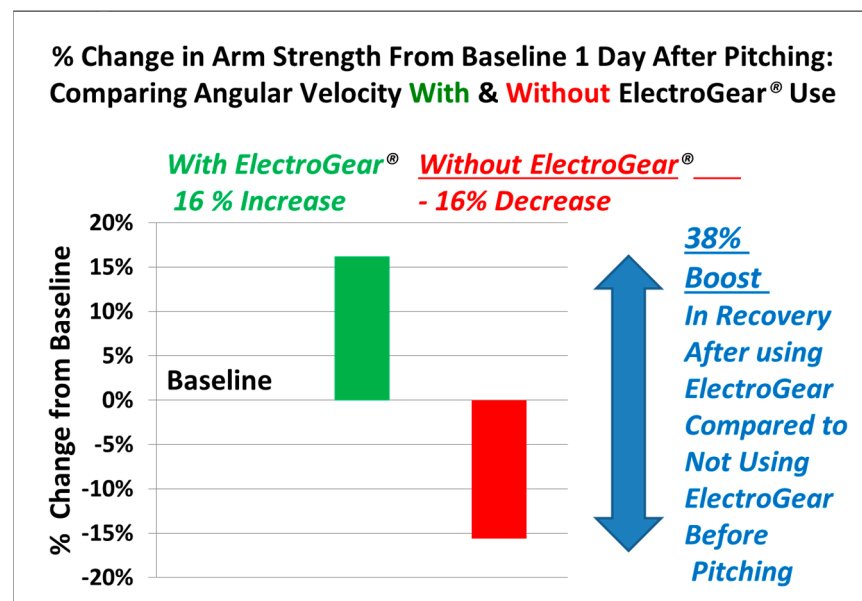


Figure 2. The baseline value (black bold font) refers to a pitching arm angular velocity of 1066 deg/s, taken immediately after the individual baseball pitcher's game performance, which is the comparator reference value to which the green bar (with ElectroGear®) and the red bar (without ElectroGear®) are directly compared to. One day after ElectroGear® treatment (green bar), the derived value of 1239 deg/s was the important 16% increase in pitching strength compared to the baseline of 1066 deg/s. In sharp contrast, in the absence of ElectroGear® treatment (red bar), the registered value of 900 deg/s was the substantial 16% natural decline compared to the baseline of 1066 deg/s. In a separate correlation analysis (blue bar), the ElectroGear® boost of 1239 deg/s, compared directly to the untreated and natural result of 900 deg/s, represented a compelling 38% improvement in pitching arm strength at the identically measured one-day milestone following the pitcher's last game.

4. Discussion

Through our case study, we have decisively demonstrated the potential benefit of a disruptive treatment paradigm for restoring muscle strength and hastening the functional recovery of an exhausted baseball pitcher's arm to accelerate the optimal strength revival from four days to just one day. Microcurrent application has already been shown to improve blood circulation in maximizing the acute responses and chronic adaptations to exercise [3]. Healables® is already developing additional applications of this Healables® technology through the Healables® electroceutical device via e-textiles for alleviating medical conditions such as fibromyalgia, osteoarthritis, painful diabetic neuropathy, dry macular degeneration, long-covid and lower back pain.

5. Conclusions

The Healables® ElectroGear® wearable knitted arm and/or sleeve with embedded microcurrent electrodes and the validating WelMetrix® physiologic motion sensors and attached Healables® ElectroGear® device present an innovative paradigm that could be utilized to enhance and monitor sporting performance and expedite recovery. Importantly, this specially knitted e-textile, with its encased dry microcurrent electrodes, represents a user-friendly and better-tolerated alternative to the current traditional use of sticky and skin-abrasive electrode pads. Finally, our case study demonstrates the superiority of our disruptive method of treatment in accelerating baseball pitcher recovery time to peak performance from 4 days to 1 day, thus maximizing the flexibility and availability of every pitcher of a regular baseball pitching staff rotation.

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Institutional Review Board Statement: Ethical review and approval were waived for this case study since the ElectroGear sports device used in the study is certified with the CE mark for its intended use as a wellness device in sports performance and recovery and in the study this wellness device was used as intended. In addition, the Healables platform technology that powers this ElectroGear device previously obtained Helsinki approval for a prior clinical trial that demonstrated device safety and usability, the primary endpoints of that study.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data supporting our reported results can be obtained by contacting M.E. at mehrenberg@healables.io.

Conflicts of Interest: At the time of the study, Dr. April was the CEO of the company that distributes the Welmetrix measuring device. In addition, at the time of the study, each of the other authors were contractually associated with Healables, the company responsible for the ElectroGear device use.

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