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The Effect of Holographic Wristbands on Proprioception

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ABSTRACT

Context: Wearing wristbands embedded with holograms at certain frequencies are believed to increase proprioception. There has been very little research to determine if holographic wristbands have any physiological effect on the body. **Objective:** To determine if the holograms embedded in the wristbands will improve proprioception during a single leg stance test on the dominant foot. **Design and Setting:** Controlled Athletic Training laboratory study. **Participants:** Twenty-four healthy college students of different activity levels (7 men, 17 women; age = 22.6 ± 1.2 years, height = 170.18 ± 12.10 cm, mass = 69.51 ± 15.63 kg) without any lower extremity injuries in the past three months participated. The subjects were also excluded if they have worn a holographic wristband in the past three months. **Intervention(s):** Each subject completed two trials under three protocols (holographic wristband, placebo wristband, no wristband) in a counter-balanced order for a total of six different tests with each test lasting 30 seconds. Subjects tested under each protocol using a single leg stance test on their dominant leg, hands on their hips, and looking forward at a fixed point on the wall. **Main Outcome Measure(s):** Balance analysis of the subjects was performed using an AMTI AccuSway Force Platform measuring Center of Pressure velocity and Center of Pressure Area 95. A statistical analysis of the data was done using repeated measures to test for differences between each condition. **Results:** The results showed no significant differences between protocols for Center of Pressure velocity ($F = 1.130$, $P = .332$). We also found no significant differences between protocols for Center of Pressure Area 95 ($F = 1.271$, $P = .290$). **Conclusions:** The results showed that the use of the holographic wristbands or a placebo wristband did not appear to have an impact on static balance. Overall, the results show that the use of the wristbands did not appear to have an impact on proprioception.

INTRODUCTION

Athletics has always been about finding a way to become bigger, better, and faster than your opponent. Proprioception has been studied as a means to improve performance and to decrease injuries.¹⁻⁴ Proprioception is defined as the ability to sense the position, location, orientation, and movement of the body and its' parts.^{1,5} There are many different ways to increase proprioception through therapeutic exercises such as plyometrics, functional-strengthening, balance training, and stability-ball exercises.^{1-3,6} There are studies that have shown that the use of mini-trampoline and dura disc training are both equally effective in increasing proprioception.^{3,7}

Holographic wristbands have taken a traditional Eastern philosophy approach to increase an individual's balance and proprioception. Theoretically, the wristbands' effect on the body occurs because the small holograms embedded within in the wristbands resonate and respond with the body's natural energy field.^{8,9} This idea is derived from Eastern philosophies in relation to a person's mind and body and the Ki that flows through everything in the world.^{8,10} Ki has many different definitions, but in relation to Eastern philosophy, Ki is seen as a function of life, which fills the life of an individual and the life of the universe.^{8,10} When the Ki flow is disrupted, the body becomes sick or unbalanced.⁸ When the body becomes unbalanced, the holographic wristband is purported to normalize the Ki flow once again, allowing the body to become balanced. When the body becomes balanced, an individual should have an increase in strength, flexibility, and balance.

Holographic wristbands were introduced in athletics having claims that they could help improve an individual's flexibility, balance, and strength.¹¹⁻¹³ The wristbands are purported to work by using small holograms embedded within the wristband that are designed to resonate with and respond to the natural energy field of the body.¹¹⁻¹³ There has been little investigation regarding the physiological effects of these wristbands. A study done by Porcari investigated the effects of Power Balance bracelets embedded with holograms on improving balance, trunk flexibility, strength, and power using a randomized, double-blind, placebo trial.¹¹ Forty-two NCAA Division III athletes completed four tests that included trunk flexibility, balance, strength, and vertical jump.¹¹ Each subject completed two trials of each test without warm-up, and during the tests, the subjects either wore a placebo bracelet or the Power Balance bracelet in a randomized order so the subjects never knew which bracelet he or she was wearing during each trial.¹¹ The results from this study showed no significant difference in flexibility, balance, strength, or vertical jump height between the Power Balance bracelet and the placebo bracelet conditions.¹¹ This study along with two other published studies have shown that there are no physiological effects that come from the use of these wristbands.¹¹⁻¹³ What is not known from the investigation about these wristbands is if there is an actual physiological effect or a placebo effect on the body that is occurring from wearing these wristbands

A secondary theory to why the holographic wristbands may increase balance is the placebo effect in which the individual believes that wearing the holographic wristband will have an effect on balance, which will cause the individual to be more aware of their body in space thus increasing balance. The placebo effect is defined as a belief that a positive outcome will result from the belief that a beneficial treatment has been received.¹⁴ The placebo effect has been known to have an effect on the body, but there are two components that are necessary that include positive beliefs and expectations by the individual and the practitioner and a good trusting relationship between the individual and the practitioner.¹⁵ The standard method of testing the placebo effect is by using a model in which the individual is randomized to an active treatment, placebo, or control group, and is not informed about the group allocation.¹⁶ If the individual knows they will be allocated to a placebo group, it can cause an element of doubt for the individual.¹⁶ The primary purpose of this study is not to determine if a placebo effect is present but to determine if proprioception will be increased by the use of the holographic wristbands.

Therefore, the purpose of our study was to determine if the holograms embedded within a wristband will improve proprioception as a result of improved static balance. We hypothesized that the use of the holographic wristbands would have no impact on proprioception, and if an increase is seen, it would be the result of a placebo effect experienced by the participant. This study is important in the investigation of holographic wristbands on proprioception by evaluating an objective measurement on whether or not the holographic wristbands will increase proprioception.

METHODS

Data were collected in a single session that lasted approximately 15 minutes. A randomized, counter-balanced design was used that allowed each subject to be their own control. The University's Institutional Review Board approved this study. Informed consent and eligibility questionnaire were completed prior to data collection.

Participants

Healthy active subjects were recruited between the ages of 18 to 24 years from the university. Participation in the study was completely voluntary. A total of 24 subjects (7 men, 17 women; age = 22.6 ± 1.2 years, height = 170.18 ± 12.10 cm, mass = 69.51 ± 15.63 kg) met the criteria of living a healthy and active lifestyle between the ages of 18 to 24 years. Potential subjects were excluded from the study if they had any lower leg injuries in the past three months, which included sprains, strains, surgeries, and/or broken bones diagnosed by a physician. Potential subjects were also excluded if they had worn a holographic wristband in the past three months.

Instrumentation

Proprioception was studied using an AMTI AccuSway Force Platform to measure how far the subjects swayed from the 95th percentile of center of pressure while in a single leg stance (SLS) on the force plate with Center of Pressure Area 95 (COPA-95).

Also measured was how fast the subjects corrected their stance when they deviated from that center of pressure point, known as Center of Pressure velocity (COPV). The analysis from the force plate was sent to a portable laptop to compile the statistical data.

Bion-X supplied all holographic and placebo wristbands used in the study. The wristbands supplied included three different sizes that were either the actual holographic wristband or the placebo wristband. The difference between wristbands was noted by a small mark on the inside of the wristband and unknown to the subjects. The wristbands were identical in order to blind the subjects to which wristband they were receiving during testing.

Procedures

The study was conducted in an Athletic Training laboratory atmosphere. A single-blinded, controlled trial was developed in which the subjects were blinded to which protocol they were receiving during the testing. Each subject was tested under each protocol, in a counter-balanced order, so that the subjects could be their own control during the testing and the learning effect and fatigue were controlled for. During the testing all subjects received the holographic wristband (HW), a placebo wristband (PW), and then no wristband (NW) as the control. The AMTI AccuSway Force Platform was connected to a laptop to allow for data to be analyzed during the testing using Balance Clinic Software. The force plate was placed 52 inches from a wall with a large black dot placed at eye level of the subjects to allow the subjects to focus on a fixed point during the testing.

Proprioception was assessed by a SLS on the dominant foot, defined as the foot that the subject would use to kick a ball. During the test, each subject stood on their dominant foot without wearing shoes or socks, their non-dominant leg bent at the knee to approximately 90°, hands on their hips at the level of the iliac crest, and looking forward at the black dot placed at eye level. Each subject completed two trials of the SLS under each protocol (HW, PW, NW) for a total of six trials. The order at which the subjects received the protocols depended on which number they were in the study. Each SLS test lasted for 30 seconds with a 1 minute resting period to control for fatigue between each trial for a total testing time frame of 8 minutes. At the end of the testing, the subjects were informed of which wristband was the HW and which one was the PW.

The data analyzed from the AMTI AccuSway Force Platform during the testing of the subjects were COPA-95 and COPV using Balance Clinic Software. The COPA-95 was measured in cm² which was a measurement of the pressure distribution while the subject completed the SLS test.¹⁷ The COPV was measured in cm/sec which was a measurement of the subject's reaction velocity around their center of pressure measurement. The data collected from the two trials under each protocol (HW, PW, NW) were then averaged to perform a repeated measures analysis of variance (ANOVA) of the data using SPSS statistical software version 20.0. A value of $p < 0.05$ was considered as statistically significant.

RESULTS

No significant differences were found between the protocols for COPV ($F = 1.130$, $P = .332$). No significant differences were found between the protocols for COPA-95 ($F = 1.271$, $P = .290$). This indicates that there were no differences between the use of HW and PW. Table 1 shows the mean and the standard deviation of the COPV and COPA-95 for each protocol.

Table 1: Descriptive Statistics Showing the Mean and Standard Deviation of The COPV and COPA-95 of Each Protocol

	Mean	Std. Deviation	N
COPV Control/No Wristband (cm/sec)	3.5729	0.79932	24
COPV Holographic Wristband (cm/sec)	3.6148	0.90534	24
COPV Placebo Wristband (cm/sec)	3.4669	0.98369	24
COPA-95 Control/No Wristband (cm ²)	7.1938	2.67808	24
COPA-95 Holographic Wristband (cm ²)	6.8971	2.19855	24
COPA-95 Placebo Wristband (cm ²)	6.4894	1.66862	24

DISCUSSION

The primary purpose of this study was to determine if the holograms embedded within wristbands would improve proprioception. The results indicate the use of a HW or a PW did not have an impact on static balance, which supported our hypothesis that HWs would not impact proprioception, and any increase would be due to a placebo effect the subjects were experiencing. However, there was no impact on proprioception in any condition, which indicates that no placebo effect occurred either.

Balance can be attributed to many different physiological effects such as age, gender, and foot types. One of the major influences of balance is a person's bare feet, which can either help with or inhibit balance.¹⁸ Three different types of foot postures that can either help with or inhibit balance include pronated, neutral, or supinated feet, based on a weight-bearing foot classification scheme.^{4,18} Tsai et al investigated the different foot structures to determine if subjects with different weight-bearing foot structures would show differences in static standing postural control.¹⁸ The results of the study indicated subjects with supinated and pronated foot structures demonstrated poorer static postural control for SLS compared to the neutral foot structure group.¹⁸ The use of bare foot testing with static postural balance testing can be seen as a major influence as to why subjects may show increased balance compared to those subjects that have decreased balance. A study done by Vereeck et al investigated the effect of gender and age on postural control and the normative data for selected tests.¹⁹ The results of this investigation showed that as age increased among both male and females, the ability to balance for the full 30 seconds decreased.¹⁹ There was no significant difference among gender between the age groups.¹⁹ This investigation along with other reports studying balance show that as an individual ages, there is a deleterious effect on standing balance.¹⁹⁻²² Age, gender, and foot type are not the only influences on proprioception. The idea of a placebo effect may also have the effect on the subject's balance when it comes to wearing a holographic wristband to increase balance.

The physical increase in balance reported anecdotally from individuals wearing holographic wristbands is likely attributed to the placebo effect. If the subjects had the belief holographic wristbands would increase their balance, they would be more apt to have an increase in balance than if they did not believe in the wristbands. Several research studies have explored the effects of the placebo effect on sports performance. Maganaris et al researched the effect of a placebo anabolic steroid among 11 national-level power lifters.²³ The authors of the study looked at two different hypothesis, which included whether the subjects would show a substantial increase in performance and that when the deception was revealed, performance would return to baseline.²³ The results of this study indicated the group who believed that they ingested steroids on the second trial still had a significant increase in performance.²³ The group informed of using a placebo anabolic steroid before the second trial had results return to baseline in performance.²³ Beedie and Foad reviewed 12 intervention studies in sports performance evaluating six studies where the dependent variable was endurance performance, four strength performance, in one, anaerobic performance, and in one, pain tolerance.¹⁴ The review showed both positive and negative placebo effects on performance, and all but one study reported either a statistically or clinically significant effect.¹⁴ Thus, an assumption from the review of different placebo studies is that an athlete performing to a higher level as the result of receiving a sham or placebo treatment has untapped psychological potential.¹¹ If an athlete has the potential to believe in what they are receiving for a treatment or performance enhancement, then that athlete will be able to compete at a higher level or have a more successful rehabilitation. Although we did not find a placebo effect in our study, future research could evaluate only those who "believe" in the effects of the holographic wrist bands to determine if the placebo effect would be present in those individuals.

The results of this study do concur with recent research that has been done on holographic wristbands. The study by Procari et al showed that there was no significant difference in trunk flexibility, balance, strength, or vertical jump height between the Power Balance bracelets and placebo bracelets worn by the subjects.¹¹ The study did show a significant increase from trial 1 to trial 2 scores; however, the order of the bracelets was not randomized. Thus the increase between trial 1 and trial 2 could be attributed to subjects being habituated to the task or warmed-up by trial 2.¹¹ Another study by Brice et al investigated the effect of holographic technology wristbands on human balance and stability performance.¹² This study concluded that holographic technology wristbands have no effect on human balance and stability performance.¹² Sari et al investigated the effects of the three aspects of holographic wristbands: strength, balance, and flexibility.¹³ The study also found that there was no significant difference between wearing the placebo wristband and the holographic wristband for strength, balance with eyes closed, and flexibility.²⁰ There was a significant difference between the wristbands with balance during the eyes open condition, with balance being better when the placebo wristband was worn.¹³ The authors discussed the potential for a placebo effect; however, the primary purpose of the study was not to investigate the placebo effect of the wristbands.¹³ This study concluded holographic wristbands have no effect on balance, strength, and flexibility.¹³ After a review of the current research, we can speculate that subjects had a learning effect causing the increase in balance. However, in our study, the counterbalanced order controlled for any possible learning effect that may have taken place.

There are many reasons why the holographic wristbands did not have an effect on static balance. The holographic wristbands may not have had a physiological impact on the body because the energy that was coming from the holograms may not have been strong enough, or the holograms in the wristbands may not have been large enough. The holographic wristbands may need to be worn for a longer period of time to provide a physiological change or impact. Overall, the results show that the use of the wristbands is not warranted to increase proprioception.

Limitations

There are limitations acknowledged in the study. The participant sample included 24 healthy subjects with no recent lower leg injuries in the past three months along with not wearing a holographic wristband. The screening of the participants for exclusion from the study was a subjective questionnaire that was filled out by each participant before the study. The sample of our study, consisting of non-athletes, should be kept in mind when comparing our results with other studies. Additionally, the subject's interest in the study and their prior belief in holographic wristbands could have had an impact on how much effort they gave during the study. It must also be taken into consideration that the current study only investigated the effects of the holographic wristbands on proprioception. The need for further research that investigates the additional effects of the holographic wristbands which includes the effects of increasing flexibility and strength is needed to have a full understanding of this technology. The duration of the study needs to be recognized as a limitation. Future research needs to be done to investigate the long-term effects of the holographic wristbands.

CONCLUSIONS

Our results showed that the use of the holographic wristbands or placebo wristbands did not appear to have an impact on proprioception. The holographic wristbands may not have had a physiological impact on the body because the energy coming from the holograms may not have been strong enough to affect the body. Also, the holograms in the wristbands may not have been large enough to show a physiological effect. Future research can be done on testing the long term effects of the wristbands, testing the different aspects of the wristbands such as flexibility and strength, and testing subjects wearing a certain shoe so foot type would not be a factor.

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