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Effects of an Ionic Bracelet on Physical, Cognitive, and Integrative Tasks

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Abstract

Abstract: One approach in complementary/alternative medicine posits that manipulations of undocumented body energy patterns (biofields) can improve health and function. Various clinician-delivered interventions focus on biofields, but devices that purportedly correct these are also marketed and claim immediate benefits in a variety of domains. OBJECTIVE: To determine acute effects of ionic bracelet use on physical, cognitive and integrative sports-related tasks. METHODS: 52 healthy young adults participated (9 men and 43 women; 20.2±3.4 years of age; 65.4±11.3 kg; 165±6.9 cm). None reported prior or current use of the product. Each completed 2 series of 6 tasks wearing the ionic and an inert bracelet (counter-balanced presentation order). Bracelets were applied by the investigators behind a shield and covered by a sleeve in a single-blind design. Center of pressure excursion in single leg stance on a dynamic surface assessed posture control; anticipation timing absolute error represented perceptuomotor performance; time difference between 2 Stroop task variants tested concentration; peak vertical jump velocity (m/s) served to test power; maximum force in an isometric dead-lift was used to test strength; and time able to hold a weight (20% of body weight) at chin level served to test endurance. Effects of test order and bracelet type were analyzed independently via paired t-tests (α=.05). RESULTS: An order effect for strength was observed, attributable to a learning effect or an artifact of the number of t-tests applied; no other significant contrast was revealed. CONCLUSION: This ionic bracelet demonstrated no immediate benefits in any of the domains examined.

Keywords

Complementary Therapies, Exercise Testing, Energy Bracelet

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INTRODUCTION

Over the last two decades, the use of complementary and alternative medicine (CAM) in the United States has been quite stable and widespread, with approximately 40% of the population seeking such treatment for a variety of concerns (Eisenberg et al., 1998; National Center for Complementary and Alternative Medicine, 2010). One area in CAM is referred to as energy medicine. The basic tenet of this field is that subtle forms of energy, referred to as biofields, permeate the body and that these can be manipulated to improve health and function (Warber, Cornelio, Straughn & Kile, 2004). It is important to note that the official position of the US National Institutes of Health section dedicated to sponsoring CAM-related research is that biofield energies are not yet measurable. Movaffaghi and Farsi (2009) provide a useful review of literature addressing the physical basis of these energies and the efforts to measure and/or alter them. A very wide range of therapies have been identified that may act on these bio-energy fields including, but not limited to; acupuncture, acupressure, various forms of clinical touch, electrostimulation, phototherapy, and magnets (Rubik, 2002).

A critical consequence of the inability to measure biofield energy is that efficacy can be tested only indirectly based on outcomes associated with interventions presumed to influence the biofield. That there is little to no governmental regulation of passive or very low energy over-the-counter devices purported to improve biofields (e.g., acupressure or magnetized bands and some phototherapy products) is also an understandable result of this limitation. In such an environment, numerous bio-energy products are marketed to enhance health and performance. What evidence exists pertaining to this broadly defined product category?

Merging magnets into bracelets, joint sleeves, shoe insoles, and seating or bedding covers is perhaps the most prevalent example in this niche. Use of a magnetic insole appeared to improve static postural control (diminished sway) characteristics in an older adult sample (Suomi & Koceja, 2001). Application of a magnetic sleeve decreased pain and increased function after 4 hours of treatment in a sample of individuals with knee osteoarthritis, but after more prolonged periods of use (one week and 6 weeks), the effect was lost (Wolsko et al., 2004). Use of a magnetic bracelet by patients with hip and knee osteoarthritis provided no pain relief or improved functioning (Harlow, Greaves, White, Brown, Hart & Edzart, 2004). Magnetic insoles were also shown to have no superiority for reduction of plantar heel pain (Winemiller, Billow, Laskowski & Harmsen, 2003) and magnetic arm bands had no beneficial consequence in the alleviation of or recovery from delayed-onset muscle soreness (Mikesky & Hayden, 2005). An acupressure band, a completely different type of intervention, but among those thought to interact with biofields, did not appear to reduce nausea associated with general anesthesia (Angarwal, Pathak & Gaur, 2000). While the cited examples tend to involve somewhat prolonged exposure, it is not at all uncommon for biofield interventions to report immediate changes at physiologic and functional levels (Rubik, 2002).

A new bio-energy manipulation appliance has emerged in the form of ionic bracelets and necklaces. The claims made for these products are similar to others in this domain; optimizing the biofield will lead to improved health, wellness and function. Interestingly, these products typically extend their application to performance enhancement for healthy and fit athletes. Indeed, prominent displays of these products are located in most sporting goods stores. Ionic energy products claim a myriad of immediate benefits including strength, endurance, balance, pain reduction, general wellness, and mental clarity. Support for their efficacy is offered in the form of testimonials, particularly from professional athletes and in dramatic, immediate responses in shopping mall demonstrations.

An important consideration in evaluating treatment efficacy, particularly in this context, is the potential for expectancy or placebo effects. Stewart-Williams and Podd (2004) conducted an extensive review of placebo effect investigations and reported effect sizes (defined as the difference between the placebo and control group means divided by the pooled standard deviation, analogous to a z-score) for several investigations quite relevant to sports performance by healthy individuals: caffeine placebos have shown effect magnitudes ranging from 0.69 to 1.28 for sensorimotor task performances and benign "allergens" can elicit airway reactivity responses of 1.26. Placebo effects in athletics, while frequently capitalized upon in application, have not been extensively examined formally. Beedie and Foad (2009) report locating only 12 studies focused on placebo interventions in sports settings published over a span of more than three decades. Nearly all demonstrated significant effects, both positive and negative. Changes generally were within 1% to 5% of baseline levels, though a 50% difference was reported for pain tolerance.

Even when single- or double-blind study designs are implemented, expectancy effects clearly pose a potential challenge to valid documentation of efficacy. In a double-blind, randomized, placebo-controlled study of an ionized bracelet's effect on general musculoskeletal pain, the placebo and ionized bracelet groups both demonstrated reductions in pain, but no differences were identified between groups (Bratton et al., 2002). This study also reported that there was no influence on the outcomes attributable to participants' beliefs about, exposure to and prior use of the product. The authors recommended that these types of interventions be rigorously tested before clinicians prescribe such to their patients.

This purpose of this study was to examine the acute effects of one such ionic bracelet with a series of rigorous, objective tests representing a wide range of sport-related functional domains including muscular strength, endurance, power, sensorimotor integration, perceptuomotor integration and attention/concentration among healthy and physically active individuals.

MATERIALS AND METHODS

The institution's human subject committee approved the study and all participants granted consent before beginning any procedures.

Participants: Fifty-two healthy and physically active adults (9 men and 43 women; 20.2±3.4 years of age; 65.4±11.3 kg; 165±6.9 cm) volunteered to participate. For 11 of these subjects (all women) data for the cognitive, perceptuomotor and sensorimotor tests were lost due to an equipment malfunction resulting in a sample size of 41 for these and 52 for the power, strength and muscular endurance tests. Exclusion criteria included previous use of magnetic or ionic appliances and fracture or surgical repair to the extremities or spine within the prior twelve months.

Procedure: Upon arrival, participants were given a briefing on the equipment, an explanation and demonstration of the tasks, and granted consent to participate. Age, activity status, injury history, height and weight descriptive information were collected. Confidentiality was maintained via assignment of code numbers. The testing involved a one-time visit, lasting approximately 40 minutes.

The study design was single-blind and counterbalanced with repeated measures. Participants were assigned to receive either the ionic bracelet or the inert bracelet initially in an alternating fashion. The ionic bracelet used is widely marketed, primarily via paid television programming and the internet, and was purchased at a local retail outlet. The inert control bracelet was a plastic and leather fashion accessory of similar size and feel. Bracelets were applied by an investigator to the right arm out of participants' sight; a screen shielded direct view, and participants were instructed to look away by focusing attention upon a mark on a distant wall. Once the bracelet was attached, the arm and bracelet were covered with a knit sleeve before the arm was withdrawn from the shield. Participants then completed the series of 6 tests, had bracelets exchanged, and repeated the test series in an identical fashion. Rest was allowed as requested between and during tests. Testing order was constant and is indicated by the order of the detailed description provided for the 6 functional performance tests below. A general warm up of gentle pedaling on an exercise bicycle was used prior to testing.

Power: Participants performed 5 trials of a counter-movement jump (CMJ) for maximum height with hands on hips from a force platform (OR6-5/SGA-6, Advanced Mechanical Technology, Inc., Newton, MA) interfaced to a data acquisition system (Ariel Performance Analysis System, Ariel Dynamics, Inc., San Diego, CA). From a quiet upright stance position, vertical reaction force sampling began and after a brief delay, participants were cued to jump as high as possible. Lab software computed velocity during the jump. Briefly, body weight was subtracted from the vertical reaction force signal and then body mass was factored out of that, resulting in an acceleration record for the participants' center of mass. This was then numerically integrated to obtain the velocity record. The peak velocity (m/s) of the best 3 CMJ trials was averaged and used to represent power in the statistical analysis.

Perceptuomotor: An anticipation timing test system (Bassin 35570 and PsymSoft II version 1.07, Lafayette Instrument Corp, Lafayette, IN) was used to examine perceptuomotor functioning. The apparatus consisted of a string of 49 lights mounted in a 2.15m long track that light in sequence; the participant attempted to press a trigger button (using the hand preferred for writing) coincident with the illumination of the final light. The system allows for controlling the speed of the light series and records the magnitude and direction of the difference between the final light onset and button press (i.e., coordinating one's movement to that of an external, independent event). Testing involved 4 different speeds (2, 4, 6 and 8 mph) presented in a balanced (each speed was presented 4 times) pseudorandom manner across 16 separate trials. A 3 s fore-period was used with every trial. Rest was allowed between trials when requested. The mean absolute error (ms) across the 16 anticipation time trials was used in the statistical analysis.

Strength: Participants completed a maximum effort isometric dead lift test by pulling on a sturdy handle bar chained to the platform upon which s/he was standing. A digital isometric dynamometer (FGE-500HX, Electromatic Equipment Co. Inc., Cedarhurst, NY) attached in series with the chain allowed for measurement of peak tension. Chain length was adjusted so the handle was at mid-thigh of each subject. Participants were instructed to develop muscle force smoothly and rapidly during testing. Each test was repeated 4 times with rest as desired between efforts. The peak isometric tension (N) of the best 3 trials was averaged and used in the statistical analysis.

Sensorimotor: Postural control reflects sensorimotor integration effectiveness. Participants performed 3 trials of barefoot, single-leg (leg opposite that preferred for kicking) stance with both eyes open on a viscoelastic foam balance pad (AIREX, Alcan Airex AG, Sins, Switzerland) atop the previously described force platform system for approximately 30 s. From the force and moment recordings, the total excursion of the center of pressure travel (cm) during the middle 25 s of the test was calculated. The center of pressure pattern is strongly related to body sway; less excursion indicates better postural control. The 3 trial average for each condition was used in the statistical analysis.

Muscular Endurance: Participants were timed (manual stopwatch) while holding a barbell weight (20% of individual body weight) with hands together using an overhand grasp at chin level until failure. Failure was defined as the instant the barbell dropped more than 4" below chin level, which was marked with tape on the participants' chests. Time to failure (s) represented endurance (the ability to sustain muscle tension) and used in the statistical analysis.

Cognitive: A simplified version of the classic Stroop conflict test was used to reflect attention and concentration performance. Two sets of 20 flash cards with color words were constructed. The test involved turning a card, assessing the color word appropriately and then sorting each into the correct color group bin. This task was completed under two conditions. In the first card set, the word and the color in which it was printed were congruent. The second card set presented a conflict; on each card the word and the color in which it was printed did not agree (e.g., the word "red" was printed in blue ink). To sort correctly, all the cards printed in red ink would go into the red bin, even if the word "green" was written on the card. The investigator used a manual stopwatch to assess the time required to sort the 20 cards. The difference between the conflicted and congruent condition times (s) was used in the statistical analysis.

After completing the functional tests, participants gave written answers for two questions: (1) In which test series were you wearing the ionic bracelet? and (2) Do you believe wearing certain substances on the body can improve performance?

Statistical Analysis: Effects of test presentation order (i.e., learning effects) and bracelet type for each functional performance test outcome were analyzed separately via paired t-tests ($\alpha=0.05$). Participant opinions were used primarily for descriptive purposes.

RESULTS

The study purpose was to examine immediate effects of an energy bracelet via a series of rigorous, objective tests representing a range of sport-related functional domains including muscular strength, endurance, power, sensorimotor and perceptuomotor integration and

Table 1. Effects of test order and bracelet type on performances.

Variable*	Test Order		Bracelet Type		
	t-ratio	Probability	t-ratio	Probability	Mean±SD
Power†	0.872	0.387	0.666	0.509	2.56±0.25
Perceptuomotor‡	0.019	0.985	1.684	0.340	48.1±22.0
Strength§	2.381	0.021	0.163	0.871	869±278
Sensorimotor‖	0.795	0.431	0.489	0.627	284.3±127.8
Muscular Endurance¶	1.623	0.111	0.500	0.619	43.3±15.7
Cognitive¶	1.346	0.186	0.461	0.647	4.1±7.4

Note. *Degrees of freedom were 51 and 40 for power, strength and endurance tests and perceptuomotor, sensorimotor and cognitive tests, respectively. †Units of measure are m/s. ‡Units of measure are ms. §Units of measure are N. ‖Units of measure are cm. ¶Units of measure are s.

attention/concentration among healthy, physically active individuals. A repeated-measures, single-blind study design was used. Participant opinions about aspects of the experience also were gathered.

Summaries of all statistical results for the functional tests are presented in Table 1. Statistical power levels were in excess of 90% for all tests. Illustrations of the respective tests and contrast groupings are shown in Figure 1. There was no significant bracelet effect for any variable tested. A test order difference (familiarity or learning effect) was identified only for strength; the second trial result was approximately 4% greater than the first (853±263 versus 887±293 N).

Participants were unable to identify the bracelets accurately. Of the 46 completed responses, 46% were correct, 43% were incorrect and 11% did not guess. Interestingly, far more (70%) thought the ionic bracelet was worn in the second test series. As to the belief in the efficacy of these products, the 48 responses received were grouped into 4 categories: 6% had no opinion, 17% believed benefits could be obtained, 19% believed these products elicit positive placebo effects and 58% opined that these products have no effect.

DISCUSSION

The major finding of this study was that no bracelet effects were identified. The strength of the counterbalanced, single-blind, repeated measures design employed in this study is an important consideration for several reasons, but especially with regard to the potential contamination introduced by learning, expectancy and/or placebo influences. Typically, support for the effectiveness of these types of products comes in the form of demonstrations and testimonials. Examination of marketing productions reveals that demonstrations start by subjecting an individual to some sort of unfamiliar, often surprising, performance challenge while not wearing the appliance. This first exposure provides a clear learning opportunity; the participant becomes acclimated or familiarized to the demands of the task, which allows for a solution to be developed quickly and implemented readily when the test is replicated while wearing the product. The second trial performance is

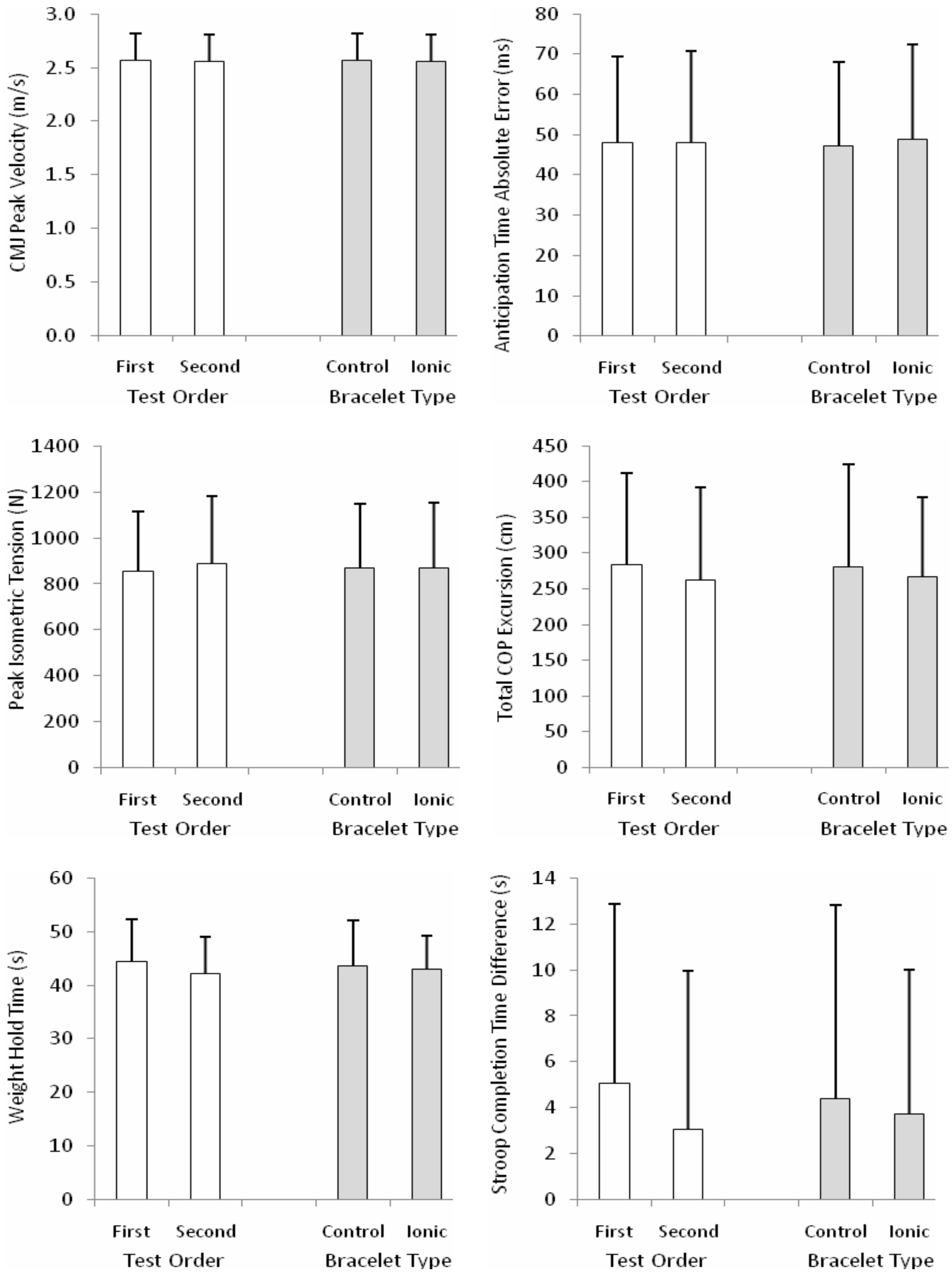

Figure 1. Test order and bracelet effects for functional task performances. See text and Table 1 for additional details. The only significant difference was an order effect for strength; isometric tension (strength) was approximately 4% greater for the second test trial.

often markedly better and the improved outcome is then attributed to the product. This conclusion is not defensible because the improvement may have been due to learning, or the product or an unknown combination of both. With this approach, expectancy and placebo effects also can infect the result and the causal attributions because the subject knows the product is being worn. Testimonials, another avenue for expectancy and placebo contamination, are particularly influenced by the high perceived status granted the professional athletes and medical professionals who frequently appear in marketing campaigns to advocate for these devices.

The results we observed, a test order effect only for strength and no significant bracelet effects at all, are enlightening. The combination of having participants being unaware of which device was worn and then performing the repeated tests in a balanced presentation order seems to have effectively blocked expectancy or placebo effects. The greater strength test result for the second trial could well be evidence of learning, as this test was arguably the most unusual and complex task (effectively coordinating the whole body to pull upward on a fixed-length of chain) and thus most susceptible to the manifestation of learning and familiarization consequences. Conversely, this outcome may simply have been an artifact due to the many statistical tests applied (inflation of alpha).

There appears to be a paradox revealed in the opinion results. While participants were unable to identify the bracelets, 70% guessed it was worn in the second test series and often attributed the guess to a sense that those performances were somehow better. Recall, however, that 58% did not believe these products work, while 36% thought they do either directly (17%) or indirectly via placebo (19%). Except for the slight difference in the strength test, all test performance contrasts were equivalent; thus, it appears many people who stated they do not believe these devices work, actually may hold some reservations about the potential for bioenergy manipulation. We also re-examined the bracelet results for the strength, power and endurance tests for the 11 individuals who stated they do believe these products work and found no significant effects. This is consistent with the findings of Bratton et al. (2002).

CONCLUSION

It is important to note the delimitations of this study. We used a younger, healthy, physically active sample; results might differ if a different demographic was tested. Only immediate effects were examined; different outcomes might occur if more prolonged exposure were allowed. Also, there are many products on the market in this category; we tested only one and details of its design specifications are completely unknown to us. The results also do not impugn other energy therapies.

In summary, it appears the study design and experimental control very effectively regulated critical confounding influences and adds strength to the conclusion that this ionic energy bracelet had no acute effect (beneficial or detrimental) for any of the broad array of qualities represented by the 6 functional performance tests we used. This result may not be surprising scientifically, but the widespread use of these types of products does add practical value and significance to the project.

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