Isometric hand grip training: a natural hypertensive therapy.

Introduction

The measurement of blood pressure is often a stressful event for many patients. During an annual check-up or trip to the local pharmacy, patients commonly experience symptoms of anxiety while waiting to have their blood pressure taken. Anxiety symptoms are likely invoked by the knowledge of the negative health risks associated with high blood pressure. Chronic elevation of blood pressure, known as hypertension, is linked with increased mortality and morbidity and is a major modifiable risk factor in cardiovascular disease. (1) Hypertension is estimated to affect nearly one billion people worldwide and is frequently termed the “silent killer,” since it often presents with no apparent symptoms. (1,2) In 2001, the total estimated costs associated with treating hypertension in the United States exceeded 50 billion dollars. (3) A recent investigation into the effectiveness of current pharmacological treatments for hypertension has demonstrated their inadequacy to control approximately 47% of affected hypertensive patients. (4) The failure of currently accepted treatments for hypertension in a large percentage of individuals has resulted in the need for effective and cost-efficient, non-pharmacological, hypertensive treatments. One promising treatment, currently being explored, is isometric hand grip exercise training (IHG). This review offers a brief introduction to isometric hand grip training and its relevance as a non-pharmacological, anti-hypertensive treatment alternative.

Hypertension

The most recent definition of hypertension describes “normal” as arterial blood pressure below 140/90 mmHg. (5) Using this criterion, prevalence rates for high blood pressure are approaching one in three in the general population. Recent guidelines also describe blood pressure values ranging between 130-139 / 80-88 mmHg as “high normal” and at increased risk for developing hypertension. (5) As mentioned, hypertension is particularly dangerous due to the lack of associated symptoms and visible signs. This absence of symptoms leaves approximately 30% of affected individuals unaware of their untreated condition. (6) While hypertension is most often managed by medications, alternatives such as exercise, diet modification, weight reduction, smoking cessation, and further lifestyle changes often produce positive results. (1,5)

Meta-analyses of numerous randomized controlled trials in normotensive and hypertensive participants have established blood pressure reductions of 3.4/2.4 mmHg (systolic/diastolic) and 5.9/4.2 mmHg with aerobic exercise and diet modification, respectively. (7,8) The largest reductions of 7.4/5.8 mmHg were observed in hypertensive participants. (8) Aerobic exercise and diet modification interventions currently represent the most effective non-pharmacological treatments available to affected patients.

Risks of Untreated Hypertension

Left untreated, hypertension results in increased all-cause mortality and morbidity. (1,5) Hypertension is a major modifiable risk factor for cardiovascular disease, and increases in resting blood pressure of 20/10 mmHg are associated with a doubling in cardiovascular risk. (1) These associated risks have further necessitated the need for more effective anti-hypertensive treatments.

Isometric Exercise

Isometric exercise is defined as a muscle contraction in which the length of the muscle remains unchanged while the tension increases. (9) This form of exercise was widely popular during the nineteenth and early twentieth centuries. Early interest focused on the differences between isometric exercise and resistance training. In particular, the ability of isometric exercise to occlude blood flow at low intensity levels (~20% maximum voluntary contraction [MVC]), thus initiating a powerful pressure response (metaboreflex). (10,11) The metaboreflex during isometric exercise occurs due to the vasoconstriction of inactive vascular beds in an attempt to restore blood flow to active muscles. (10,11) The blood pressure and heart rate responses to isometric exercise are influenced by the force of the contraction, (12) the size of the contracting muscle, (13) and the duration of contraction. (14) In contrast to resistance training, isometric training elicits a pressure load on the heart. (9)

Concealed Carry Mistakes:
The Worst Thing a Permit Holder Can Do & More Concealed Carry Tips.

Two early studies examining the effects of isometric exercise on the incidence of hypertension demonstrated lower rates of hypertension in individuals performing occupational or whole-body isometric contractions. (15,16) These studies were conducted in both medicated and unmedicated individuals of varying resting blood pressures and were predictive of the potential ability of hand grip training to reduce resting arterial blood pressure and/or lower the incidence of hypertension. (15,16)

Isometric Hand Grip Studies

Following the studies by Kiveloff and Huber (1971) and Buck and Donner (1985), isometric research has focused on the ability to utilize isometric hand grip exercise as an intervention in the treatment of hypertension. Wiley and colleagues (1992) conducted the first isometric hand grip training study, which demonstrated 13 mmHg and 15 mmHg reductions in systolic and diastolic pressure, respectively. (17) These participants completed four two-minute contractions separated by three-minute rest periods at 30% MVC, 3d.[wk.sup.-1] for eight weeks. In an accompanying study, participants trained with four 45-second contractions separated by one-minute rest periods at
In 2000, Ray and Carrasco trained normotensive participant's 4d.[wk.sup.-1] for five weeks. These participants completed four three-minute contractions at 30% MVC, with each contraction separated by five-minute rest periods. This five-week training protocol produced a 5 mmHg reduction in diastolic pressure and a 4 mmHg reduction in mean arterial pressure, but no changes in systolic pressure. (18) The results of this study were not surprising as normotensive participants probably do not have a large potential for improvement. In a study conducted at McMaster University (Hamilton, Ontario, Canada), hypertensive participants undergoing isometric hand grip training had significant reductions in systolic, diastolic, and mean arterial pressures with accompanying decreased sympathetic stimulation and increased vagal modulation. (19) This protocol mimicked that of Wiley and colleagues (1992) and produced reductions of 19 mmHg, 11 mmHg, and 7 mmHg, in systolic, mean arterial, and diastolic blood pressure, respectively. (19) In a more recent study, ten pre-hypertensive participants achieved an average reduction of 13 mmHg in systolic pressure following six weeks of isometric hand grip training 3d.[wk.sup.-1] at 50% MVC. (20) These blood pressure alterations were associated with reductions in exercise-induced reactive oxygen species, a possible mechanism for the observed attenuations. (20)

In contrast, a separate study looking at eight weeks of isometric hand grip training in medicated hypertensives produced no significant changes in resting blood pressure, (21) but there was a trend towards decreased systolic blood pressure (p = 0.08). (21) These results may hint at a confounding effect between certain classes of antihypertensive medication and IHG. The contrasting results reinforce that investigations on blood pressure reductions with training must possess strict controls to limit potentially confounding variables, such as familiarization, measurement error, and collection times.

The proposed mechanisms behind the reductions in resting blood pressure with isometric hand grip training include alterations to the autonomic nervous system, endothelial function, oxidative stress, arterial compliance, and/or baroreceptor (stretch receptors in the vessel) sensitivity. To date, conclusive identification of the mechanism(s) responsible for the reduction in blood pressure has eluded researchers. It is possible that IHG training results in the adaptation of numerous pathways involved in the regulation of arterial pressure.

Available IHG Products

The large number of affected patients not controlled by antihypertensive medications has necessitated the need for alternative treatments. Isometric hand grip training represents a promising treatment option for hypertension. Currently, only one manufacturer produces hand grip devices specifically designed for hypertensive treatment (Zona Health, Boise, Idaho, US). These devices have been cleared by the Food and Drug Administration (FDA) and have been utilized in multiple research studies to date. The Zona Plus hand grip trainers represent the most proven IHG option for affected patients. The Zona Plus devices include a visual display to provide patients with continuous instruction and feedback during training. The display, in combination with auditory signals, ensures easy to use instruction for participants. Research conducted at McMaster University (Hamilton, Ontario, Canada) with the Zona Plus hand grips has demonstrated high compliance and usability. (21) These studies have been conducted on a wide range of participants, with ages ranging from 20-80 years of age, with no known difficulties. One major benefit of the Zona Plus hand grips, in comparison to alternative hand dynamometers used in other studies, is their size and portability. The ability to take the hand grip anywhere, regardless of electrical outlets and personal computers, allows continuous training in any environment (work, home, or travel). The on-board processor allows the Zona Plus hand grip to be used by multiple users without reconfiguration—thus allowing families and patients the ability to further offset fees by splitting costs. This may be important, as hypertension is acknowledged to have a large genetic component. (22,23)

An important aspect that IHG training addresses (besides the attenuation of resting blood pressure) is the lack of available time for lifestyle modifications. The protocol utilized by multiple research studies amounts to a total of 36 minutes per week, including rest periods. (17, 19, 21) Thus, in comparison to aerobic and resistance training, this modality represents a significant decrease in required time, a major obstacle in today's society. Each training session requires 12 minutes of hand grip exercise, allowing for its completion during a work break or lunch. It should be advised that the American College of Sports Medicine (ACSM) still recommends more than 20 minutes of exercise three to five times per week for full cardiovascular benefits. (24) IHG training presents a form of exercise training accessible by people of all ages, as opposed to aerobic and resistance training, which have many exclusion criteria and concerns. The exclusion criteria for IHG include individuals suffering from debilitating arthritis, carpel tunnel, peripheral neuropathy, an aneurysm, or mitral valve complications. (25)

The hand grips available from Zona Health help fill the current void for IHG products. With these devices, affected hypertensive patients now possess an alternative treatment method to standard pharmacological anti-hypertensive medications. The IHG modality represents a substantial reduction in time requirements compared to alternative lifestyle modifications, while yielding similar or even greater results.

Future Studies

The area of isometric hand grip training is only beginning to be uncovered. While numerous IHG studies have been completed, this area still lacks a large scale, multi-centered investigation to determine the exact effectiveness of training as an adequate anti-hypertensive treatment. A study of this magnitude would finally confirm the efficacy of IHG in the treatment of hypertension. Other studies are needed to elucidate the mechanisms responsible for the blood pressure-lowering effect and to identify the optimum training protocol.

Finally, little research has been conducted on the effects of extended training (more than three months) and the effects of training cessation. Preliminary data suggest a return to baseline values occurs following approximately six weeks after cessation of training. It may be that a cyclic training schedule (e.g., six weeks on, two weeks off) or reduced training will be sufficient to maintain the positive adaptations of training. Once these studies have been completed, the efficacy of IHG as an anti-hypertensive treatment will be confirmed.

Summary

The prevalence of hypertension in combination with its related effects on quality of life has made blood pressure one of the most treated cardiovascular disease risk factors. Evidence demonstrating the inability of anti-hypertensive, pharmacological treatments to adequately treat patients has resulted in the need to explore new lifestyle modification strategies. In recent years, isometric hand grip training has demonstrated the potential to be a promising anti-hypertensive option. Research completed on this training modality has revealed significant reductions in systolic and diastolic blood pressure up to 19 mmHg and 15 mmHg, respectively. Currently, the only digital isometric hand grip product available to the general public is produced by Zona Health (Boise, Idaho, US). This line of hand grips has been utilized in numerous research studies and is designed to ensure ease of use and simplicity, while yielding the beneficial effects of training. Research on isometric hand grip training still needs to address potential mechanisms for observed attenuations, effects of chronic training, and the determination of the most effective hand grip protocol(s). Isometric hand grip training also minimizes one common barrier to exercise, the time required. The current training protocol requires 12 minutes per session, enabling the completion at home or work. The positive results of IHG training support its use as a non-pharmacologic treatment for hypertension.

Philip J. Millar, MSc
Department of Kinesiology
McMaster University
Hamilton, Ontario, Canada
Notes


by Philip J. Millar, MSc

Copyright 2008 The Townsend Letter Group
No portion of this article can be reproduced without the express written permission from the copyright holder.
Copyright 2008 Gale, Cengage Learning. All rights reserved.

Please bookmark with social media, your votes are noticed and appreciated:

Reader ratings: 5 [1 vote(s)] You can rate this article by selecting 1 to 5 stars on the left.

Reader Opinion

Title: 

Comment: 
Author: Millar, Philip J.
Publication: Townsend Letter
Geographic Code: 1CANA
Date: Jan 1, 2008
Words: 2647

Previous Article: Types of food allergy testing.
Next Article: Another look at the China Study.

Topics: Hypertension
Care and treatment
Research

DID YOU KNOW: IF YOUR CAR IS OVER 3 YEARS OLD, INSURANCE COMPANIES HOPE YOU DON'T KNOW THIS RIDICULOUSLY EASY TRICK

TAP YOUR AGE:

18-25 48-55
26-35 56-65
35-45 68-75

Calculate Payment

Get Firefox