

Migraine Relief

With

Biofeedback

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Migraine Relief with Biofeedback

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This document describes some good news for a throbbing head.

Summary

This monograph is about one of the two major categories of headaches, migraines, and how to heal migraine headaches with biofeedback. Migraine headaches are related to problems with cerebral blood flow. Biofeedback has been shown in many studies over the last 25 years to modify the blood flow to the peripheries and to the head. Migraine sufferers have found significant relief by learning to increase circulation to the extremities, which in turn reduces excess blood flow to the head. As circulation problems are corrected, this usually reduces or eliminates the pain associated with migraines. The simplest method to increase blood flow to the extremities is to increase the temperature of the hands with temperature biofeedback.

Migraine



What is a Migraine

Vascular Headache versus Tension Headache

The two general categories of headache are muscle tension and vascular. Migraine is the most common form of vascular headache. (Hangover is another common vascular headache.) Vascular or tension headaches are two ends of a spectrum. People can be anywhere along that spectrum and have a mixture of both tension and vascular symptoms. Sometimes the pain of a vascular headache can tense the muscles to the point of creating a tension headache too.

Since the physical mechanisms of vascular and tension headaches are different, the biofeedback techniques to help each type of headache are different. Some people with combination or “complex” headaches need to practice both types of biofeedback for complete relief. Temperature or blood flow biofeedback helps the vascular headaches, muscle tension (EMG) feedback helps the tension headaches.

There are other causes of headaches such as a virus infection like influenza, head injury, brain tumor, drug side effects, or meningitis. These are not conditions generally treated

by biofeedback. However, headaches from high blood pressure have been treated with biofeedback by reducing the blood pressure.

Migraine Symptoms

The word “migraine” comes to the English language via French from the Greek word “hemikrania”. Hemikrania means half the head. This shows humans have been suffering from migraines for at least 2,000 years. As the word root shows, migraines often begin or stay in only half the forehead. Once the pain begins to throb in half the head, then slowly the entire head may begin to ache. The other major aspect of a migraine is nausea or vomiting. During a migraine bright lights may become difficult to stand, a condition called photophobia. During the migraine the eyes may become bloodshot and the sufferer looks pale and sick. Sometimes, if the pain is centered between the nose and eye, the nose and eye can start running. Occasionally the sufferer feels numbness or tingling down one arm, dizziness, or ringing in the ears. Migraine headaches are more severe in intensity than tension headaches, and are more likely to drive people to see a medical doctor.

Another unique indicator of migraines is are early warning symptoms called prodrome. This may be a visual disturbance such as misting over or flashing lights or blind spots in the visual field. There may be other sensory or motor disturbances. These early warning signals may last minutes or hours. When the prodrome symptoms fade, the pain starts.

There are four general types of migraine. The *classic migraine* has a clear prodrome before the headache begins. The *common migraine* has no early warning symptoms. *Cluster migraines* appear in groups. The last category is called *complicated* or *complex migraine* because it is a mixture of vascular and tension headache symptoms.

Migraines rarely start before puberty or after about age 40. The tendency toward migraines runs in families.

Migraines are severe but usually not dangerous to life and limb unless someone tries to drive or operate machinery while under the influence of the migraine or any medication taken to treat the condition.

Migraine Causes

The generally accepted cause of the prodrome sensations is because the intracranial (within the head) arteries constrict and the blood supply to certain brain cells is restricted to the point of causing sensory or motor sensations. When the constriction phase ends, the intracranial arteries rebound and dilate (vasodilation) which stimulate the stretch receptors that feel pain. The throbbing sensation correlates with the beating of the heart because each heartbeat causes a temporary rise in blood pressure.

Often migraine sufferers have cold hands and feet. This is due to a chronic problem with vasoconstriction. This problem can show up in several ways: when a person changes from horizontal to vertical posture, the body must constrict some vessels and dilate others. Migraine sufferers tend to suffer when they rapidly change posture. Secondly, when the hands or feet of a migraine sufferer are placed in cold water, their blood vessels

constrict the same as the non-suffer, but the migraine sufferers take longer than average for the blood flow constriction to return to normal and the extremities to warm up again.

Certain foods can act as triggers, especially if they effect the vascular system. These include chocolate, red wine, coffee and even cheese.

Biofeedback

What is Biofeedback

Bio = life, feedback is information returned to the source.

The brain during ordinary consciousness has awareness and control over some body functions. We can move our arms or legs and other voluntary muscles. We are aware of the 5 senses when we place attention on them. Yet many automatic (autonomic) biological processes are going on without conscious awareness. The heart beats, the lungs breath, and the blood flows even when we are asleep. The brain controls these autonomic functions, but with an older part of the brain than we normally are not in conscious contact with. The brain is organized in layers depending on when in the course of animal evolution that brain structure appeared. The parts of the brain that govern some autonomic processes are called the “reptilian” brain, which first appeared in animals hundreds of millions of years ago. The most recent parts of the brain, the pre-frontal lobes, are what we have the most conscious control over. Biofeedback allows the newer parts of the brain that have to do with reason to communicate with the older parts that are tied to the emotions and the physical body.

Biofeedback electronics measures these automatic activities of the body, and displays the measurements in a form the conscious mind can easily understand, either as visual or audible information. Through the electronic intermediary, the conscious and unconscious parts of the brain are put in communication. The biofeedback practitioner through this new communication medium learns to sense and modify previously unconscious behaviors. Once the new subjective awareness and control is learned, the biofeedback electronics are no longer needed.

Mind and Body

Many studies over the last 25 years have shown that migraine sufferers can significantly reduce the number and intensity of headaches using simple biofeedback techniques. It may seem surprising that the mind can have such a powerful effect on the body. Hypnotists have shown for over a century the power of the mind over pain and supposedly “unconscious” activities of the body. Over thousands of years yogis have shown amazing abilities to control autonomic biological processes. The placebo effect, created entirely by the mind, is one of the most profoundly curative medicines in the world, and has healed almost any illness in someone. Yet the power of placebo is not available at will to the conscious mind.

There is a saying what whatever one becomes more conscious of improves. When the conscious mind is made aware of a physiological process related to an illness, it can usually change that process.

What Forms of Biofeedback Help Migraines

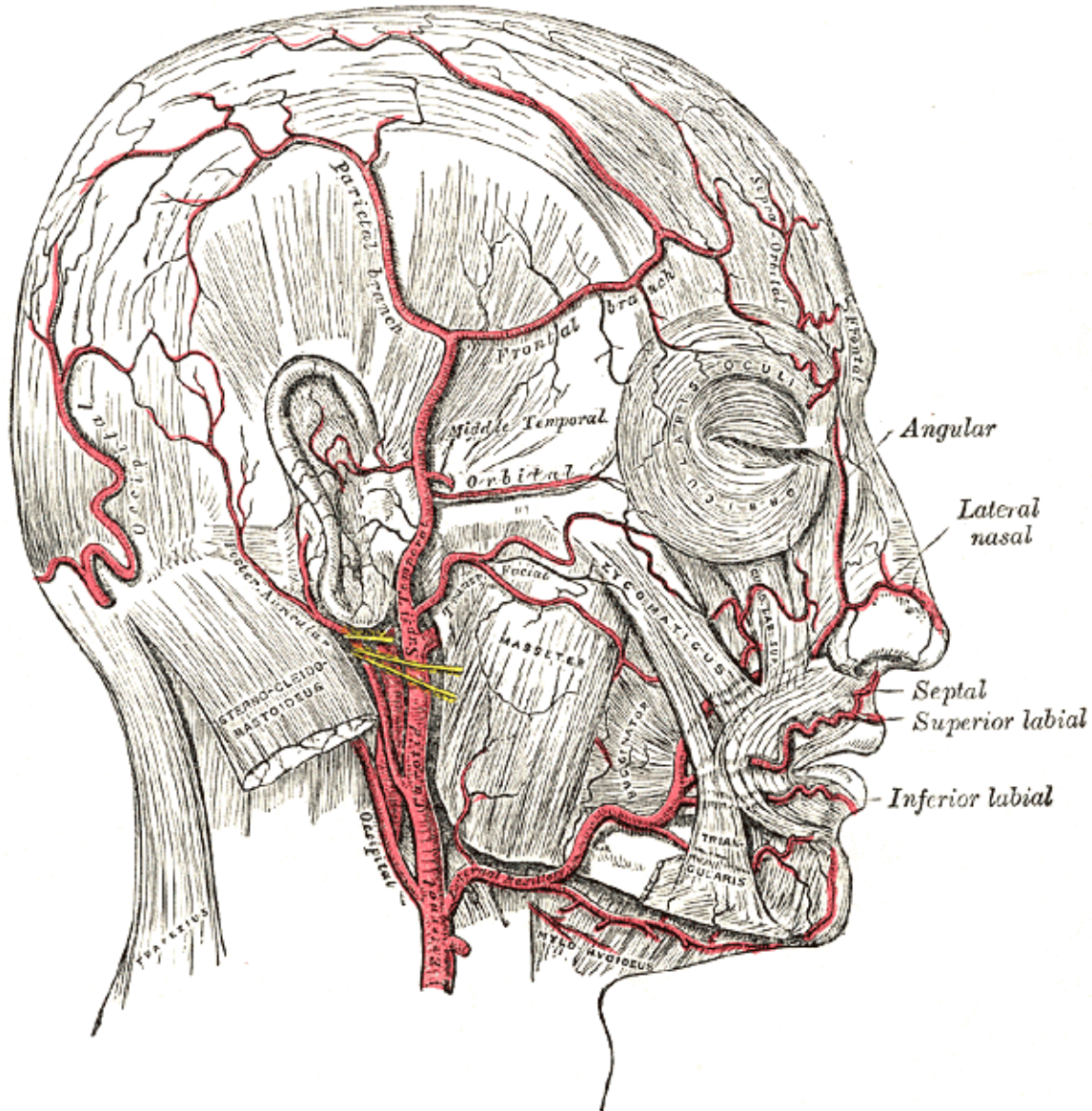
There are two types of bodily information electronically monitored for migraine relief biofeedback. One type is an indirect indicator of blood flow to an area, and that is skin temperature. The second measurement type is to directly monitor blood flow.

Temperature is measured by thermistors or thermocouples attached to appropriate electronic circuits. Blood flow is directly measured with a photoplethysmograph by infrared or reflected light.

Skin temperature is most conveniently measured on the pad of the middle or index finger. The temperature on the finger is a good indicator of vasoconstriction of the blood vessels in the extremities. There have been a few studies using temperature of the skull or forehead, but with no better results for the increased inconvenience. Some Autogenic Training commands are to create a “cool forehead” which is what the cranial temperature measurements were striving for. (Autogenic Training was a system developed in the early 1900’s to facilitate relaxation.)

A photoplethysmograph has most successfully been used on the temporal artery to directly measure and provide biofeedback on the blood flow to the brain. Practitioners have been able to reduce blood flow in that artery by up to 20%. The benefits from temporal artery blood flow reduction were identical to benefits from hand temperature warming. Blood flow biofeedback has also been done for flow in the hands, but with mixed results.

The figure below illustrates the major arteries of the head. The temporal artery is behind the eyes, behind the middle temporal region. Reducing blood flow in that artery has given more benefits than reducing blood flow in more accessible peripheral arteries.



If the migraine headaches are complex or if there is a stress component, then EMG muscle tension biofeedback has also been beneficial.

History of Migraine Biofeedback

Like most great discoveries, the healing of migraines with biofeedback was an unplanned accident. The psychologists Elmer Green, Alyce Green, and E. Dale Walters of the Menninger Foundation in Topeka, Kansas, were researching some aspects of Autogenic Training. The principles of Autogenic Training were developed in the early 1900's to give people conscious control over some body processes such as relaxation and temperature of the extremities. These psychologists were monitoring hand temperature with a polygraph. As luck would have it, one of the volunteers was a migraine sufferer. The psychologists monitored her hand temperature during a headache, and noticed the hand temperature suddenly rising 10 degrees. They asked her what had just happened and she exclaimed, "How did you know my headache went away?"

The research psychologists were intrigued and mentioned it to other people in the department. Two other migraine sufferers volunteered for the hand warming training. The temperature training devices that the researchers had built were used for what they called Autogenic Feedback Training that was a combination of Autogenic Training and temperature biofeedback, (although the word biofeedback wasn't coined yet). One of the volunteers was partially relieved of migraines, the other eliminated migraines entirely. This was so dramatic that a pilot study was set up with 75 migraine sufferers. Thus began the first of many studies in migraine relief.

Another related experience at about that time at the Menninger Foundation were studies of the visiting Indian yogi, Swami Rama. They found he could within minutes make his hand 10 degrees warmer on one side than the other side of the same hand. One side of the hand became red, the other side gray. This convinced the research psychologists that the human brain had the potential for enormous control over unconscious body processes. Mental control over the body has been practiced for thousands of years in the Far East. Biofeedback is just a way for western people to gain the same level of control as yogis have had for millennia. [1]

Research Studies

Countless research studies have been done about various aspects of migraine biofeedback. A complete listing of studies would be boring and repetitious. This is the way of science, to triple check and duplicate any findings. Here are a few studies from research indexed in MedLine.

Several researchers have studied whether hand warming or temporal blood flow monitoring produce better results for biofeedback. The study concluded the benefits are equal for both approaches. [2]

Other researchers studied whether biofeedback practice worked better at home or in a clinic. The result was no difference in benefits. [3], [4], [5]

One study compared temperature biofeedback with meditation for stress relief. The biofeedback worked better. [6]

Another researcher examined how long the benefits last after the formal training is done. He found that the benefits were still active after 6 years. [7]

Another study compared the benefits of drug therapy versus biofeedback. The benefits of biofeedback were almost identical to drug therapy, and both were better than placebo. [8]

Some migraines in women are related to the menstrual period. One study compared the effectiveness in biofeedback treatment of menstrual versus non-menstrual related migraines. Biofeedback was equally effective at both types of migraine. [9]

Another study examined whether biofeedback training or Autogenic training help children with migraines. The result was both forms of training helped, but biofeedback helped more. [10]

The list of research studies could go on and on. While multiple studies give confidence, for individual migraine sufferers the only real test is to try biofeedback for themselves.

How to Perform Biofeedback for Migraines

Overview of the Biofeedback Procedure

Increasing the temperature of the hands increases blood flow to the extremities, and reduces excess flow to the cranium. By the regular practice for 20-30 minutes of hand warming sessions almost anyone can learn to increase hand temperature at will. Over time, the base hand temperature increases, which reduces the probability and severity of a migraine attack. Secondly, when a migraine sufferer detects the preliminary warning signals (prodrome), they can take an immediate break and increase hand temperature. Hand warming often cancels the impending headache.

Hand temperature training consists of attaching a sensor to a finger, and practicing relaxation exercises while attending to visual or auditory feedback that indicates the changing finger temperature. After 1-2 months the practitioner learns the skill of hand warming, plus learns the subjective indicators of hand warmth, and no longer needs the electronic equipment.

Temperature Biofeedback

Described here is the easiest, simplest and least expensive form of biofeedback for vascular headaches. The main skill to learn is how to increase the temperature of the hands. The temperature of the hands relates to the blood flow to the extremities. The warmer the hands, the more blood flow in the extremities. During a migraine attack, there is excess blood flow up the temporal artery to the cranial area and decreased blood flow to the extremities. Through regular practice of hand warming techniques, the vascular system is retrained and the tendency toward migraines is reduced. When the preliminary (prodrome) sensations are experienced, hand-warming techniques can often prevent the headache from happening.

How Often

At a minimum, training requires 2-3 sessions of 20 - 30 minutes duration every week. Some people found short sessions of several minutes at a time several times a day is even more effective at interrupting the vascular constriction that leads to a migraine. Most people combine regular biofeedback using electronic instruments with daily Autogenic relaxation self-training that involves repeating phrases such as “my hands are getting warm, my hands are getting heavy.”

How Long to Learn

How long it takes to learn hand warming varies widely. Some people with very cold hands, but who have experience with meditation or self-hypnosis can warm hands by 20 degrees in the first session. For other migraine sufferer's progress can be very slow, with initial temperature changes being only 1 degree. If you do not have experience with meditation or self-hypnosis, or find the initial temperature change to be small, then it's recommended that you purchase guided relaxation tapes from one of the biofeedback thermometer vendors. If your hand change is small then know that you have a lot to gain from the biofeedback training and that even a 0.1 degree increase is encouraging. After a few months of training as much as 20 degrees temperature increase can be quickly produced. The base (initial resting) temperature will also rise with continued training. Some people may start with hands as cold as 74 degrees Fahrenheit, and later warm up to have hands over 90 degrees.

After a couple months of practice a person learns the sensations of warming hands and no longer needs electronic instruments to indicate when the hands are changing temperature. Then, whenever a headache prodrome is experienced, the person can take some time to relax and warm their hands, averting the headache before it starts.

To quote the experts David Olton and Aaron Noonberg, "For about 80% of the people who seek treatment [with biofeedback], however, headache activity is substantially reduced or eliminated after about two months of treatment." [12]

Rate of Learning

The speed at which individuals learn to change hand temperature varies widely. For people who suffer from migraines, who have problems with vasoconstriction, the training can seem agonizingly slow. In the first few sessions a person is lucky to produce 1 degree of temperature increase. It takes a couple months to learn to generate the 5-10 degree temperature increase that produces significant symptom improvement. Take heart in the beginning and know that any increase at all is a cause for celebration. The very fact that training is more difficult for migraine sufferers is an indication of how much their body needs improvement in that area. If the body could easily change blood flow to extremities, it would probably not have the migraine symptoms.

Setup for Temperature Biofeedback

The biofeedback subject sits in a comfortable chair, with one arm resting on a flat surface in front of them such as on a table. The setup for temperature biofeedback is to tape or Velcro wrap or office tape a small thermistor or thermocouple sensing element to the index or middle finger of one hand. The sensing element is connected by a wire to the equipment box that has the feedback display electronics. Pick a hand and a finger and use that same finger for the duration of the training. The temperature should be displayed for the subject to an accuracy of 0.1 degree. Optionally, the equipment that monitors changes in temperature also generates an audio tone. The audio feedback may be a tone that changes pitch or clicks that change repetition rate. If the equipment has a meter scale, set

the sensitivity so the needle will go full scale for the expected amount of temperature change during the entire session. This range is only a single degree initially, but may be a 10 degrees range after practice. Professional equipment usually connects to a computer to record the temperature change in order to monitor the progress over one session and as well as progress over multiple sessions.

The subject relaxes their arms, optionally repeating autogenic training phrases such as, “My hands are getting warm.” Through the feedback from the electronics device, the subject learns what mental and physical states increase and what states reduce the temperature of the hand.

In between formal training with the equipment, the subject should practice the autogenic relaxation on his or her own. The self-training should be done every day, either for one longer session of 20-30 minutes or several short sessions of a few minutes each.

Record Progress in a Journal

It is also important to keep a written journal of headache frequency, intensity and duration. This will give valuable, objective encouragement of the health results from the biofeedback training. Ideally, keep written records of headache frequency for 4 weeks prior to beginning training to establish a baseline of pre-treatment headache discomfort.

The usual subject takes 1-2 months to learn the hand-warming skill well enough to produce significant reduction in headache activity.

Relaxation Training

Either combined with electronic temperature feedback, or to supplement the formal training sessions, relaxation exercises are important to the vascular training process. There are many different relaxation strategies and biofeedback subjects tend to improvise and make up their own approach tailored to their own learning style.

Verbal

Verbal strategies involve repeating to one self phrases like, “my hands are getting warm, my hands are getting heavy.” The feet also need to be relaxed in a similar fashion. The verbal warming phrases are combined with verbal self-talk to relax the muscles, and to slow the breathing.

Visual Imagery

The subject imagines warm white or golden light filling the body and flowing into the hands and feet. One can also imagine floating in a warm ocean or drifting in a warm river.

Kinesthetic

Everyone has a different style of learning. Some learn by words, some learn better with pictures. Kinesthetic learners remember by the feeling in their muscles. For these kinesthetic learners, progressive relaxation can work well. This means putting the

attention on each muscle group in the body, beginning at the extremities (hands and feet), and relaxing each muscle group. The attention and relaxation is moved up the limbs, through the torso and spine, and finally through all muscles in the head.

Professional versus Home Equipment

There are two general levels of biofeedback equipment: home and professional. The professional units usually connect to a personal computer, respond more quickly, graph the changes over a session, and track the changes over the course of many sessions. Professional units are a factor of 10 times more expensive and often require a second person to be present besides the person receiving biofeedback training.

This monograph is directed toward the home user of biofeedback equipment. Described below are two examples of home units for temperature training.

Stress Thermometer™

One inexpensive hand temperature biofeedback system is the Stress Thermometer™. It consists of a thermistor that one office-tapes or velcro-wraps onto the middle finger of the hand. The progress with hand warming relaxation is displayed on the LCD display. The unit also displays room temperature, which is useful to record the room temperature in the journal since the starting temperature of the hand will change with room temperature. The amount of change from hand warming is fairly independent of the room temperature unless the room temperature is very hot.



The Stress Thermometer can also show the current time. This is useful since it helps time the duration of a practice session. Also, the body temperature changes with time of day, so it is helpful to record the time of day in the journal. The price for a single unit without biofeedback training instructions is approximately \$20 to \$40. There is a slightly more expensive unit that also includes guided relaxation audio tapes. These tapes can be useful for people who are not experienced in meditation or relaxation techniques.

Biodigital, also called BIO-MON



This unit has audio feedback and visual temperature feedback through an optional display unit. The price is around \$50 for audio only and \$80 for audio and a separate unit with visual feedback.

Blood Flow

For those wishing to perform biofeedback on blood flow using a photoplethysmograph instead of a thermistor for skin temperature, consult the documentation provided with the equipment. The frequency and duration of treatments is the same as for hand-warming training. The same guideline of keeping a journal of symptoms holds true. The only difference is feedback is given directly on blood flow instead of on skin temperature.

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Web Links

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