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Biomedical Engineering Study Demonstrates the Healing Value of Magnets

News Source: Research News

Jan. 2, 2008 — Magnets have been touted for their healing properties since ancient Greece. Magnetic therapy is still widely used today as an alternative method for treating a number of conditions, from arthritis to depression, but there hasn't been scientific proof that magnets can heal.

Lack of regulation and widespread public acceptance have turned magnetic therapy into a $5 billion world market. Hopeful consumers buy bracelets, knee braces, shoe inserts, mattresses, and other products that are embedded with magnets based on anecdotal evidence, hoping for a non-invasive and drug-free cure to what ails them.

"The FDA regulates specific claims of medical efficacy, but in general static magnetic fields are viewed as safe," notes Thomas Skalak, professor and chair of biomedical engineering at U.Va. Skalak has been carefully studying magnets for a number of years in order to develop real scientific evidence about the effectiveness of magnetic therapy.

To listen to Dr. Skalak discuss the study, click on
http://www.virginia.edu/flashaudio/uva_player2_content.html?the_file=news/magnet_study.xml

Skalak's lab leads the field in the area of microcirculation research—the study of blood flow through the body's tiniest blood vessels. With a five-year, $875,000 grant from the National Institutes of Health's National Center for Complementary and Alternative Medicine, Skalak and Cassandra Morris, former Ph.D. student in biomedical engineering, set out to investigate the effect of magnetic therapy on microcirculation. Initially, they sought to examine a major claim made by companies that sell magnets: that magnets increase blood flow.

The researchers first found evidence to support this claim through research with laboratory rats. In their initial study, magnets of 70 milliTesla (mT) field strength—about 10 times the strength of the common refrigerator variety—were placed near the rat's blood vessels. Quantitative measurements of blood vessel diameter were taken both before and after exposure to the static magnetic fields—the force created by the magnets. Morris and Skalak found that the force had a significant effect: the vessels that had been dilated constricted, and the constricted vessels dilated, implying that the magnetic field could induce vessel relaxation in tissues with constrained blood supply, ultimately increasing blood flow.

Dilation of blood vessels is often a major cause of swelling at sites of trauma to soft tissues such as muscles or ligaments. The prior results on vessel constriction led Morris and Skalak to look closer at whether magnets, by limiting blood flow in such cases, would also reduce swelling. Their most recent research, published in the November 2007 issue of the American Journal of Physiology, yielded affirmative results.

In this study, the hind paws of anesthetized rats were treated with inflammatory agents in order to simulate tissue injury. Magnetic therapy was then applied to the paws. **The research results indicate that magnets can significantly reduce swelling if applied immediately after tissue trauma.**

Since muscle bruising and joint sprains are the most common injuries worldwide, this discovery has significant implications. "If an injury doesn't swell, it will heal faster—and the person will experience less pain and better mobility," says Skalak. This means that magnets could be used much the way ice packs and compression are now used for everyday sprains, bumps, and bruises, but with more beneficial results. The ready availability and low cost of this treatment could produce huge gains in worker productivity and quality of life.

Skalak envisions the magnets being particularly useful to high school, college, and professional sports teams, as well as school nurses and retirement communities. He has plans to continue testing the effectiveness of magnets through clinical trials and testing in elite athletes. A key to the success of magnetic therapy for tissue swelling is careful engineering of the proper field strength at the tissue location, a challenge in which most currently available commercial magnet systems fall short. The new research should allow Skalak's biomedical engineering group to design field strengths that provide real benefit for specific injuries and parts of the body.

"We now hope to implement a series of steps, including private investment partners and eventually a major corporate partner, to realize these very widespread applications that will make a positive difference for human health," says Skalak.

— Written by Melissa Maki

http://www.virginia.edu/uvatoday/newsRelease.php?id=3573#

To listen to Dr. Skalak discuss the study, click on
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HEALTH

Let The Force Be With You

How do you spell relief? More and more doctors and people with chronic pain are spelling it m-a-g-n-e-t-s.

After being involved in a two-car collision, a driver is wheeled into the emergency room at Jackson Memorial Hospital in Miami, one of the biggest trauma centers in America. Suffering from a couple of broken bones, the patient is entrusted to the care of Dr. Richard Rogachefsky. After his work is done, Rogachefsky suggests that for a complete and speedy recovery, the patient consider using magnets. Using what? It turns out the good doctor has been prescribing magnets for his patients for the past four years.

"In my work, I'm always looking for any edge I can get," says the thirty-eight-year-old orthopedic surgeon. I've used magnets on about 600 people, in a lot of different situations, including injuries from car crashes and shotgun wounds. I've found they accelerate the healing process.

An X-ray doesn't lie," Rogachefsky continues. "I've seen bones heal ten days faster through the use of magnetic fields. I don't preach, but I tell patients they really work."

Westerners once flouted a therapeutic wonder from the Far East that used humans as pincushions. Today, the ancient art of acupuncture is widely accepted as a treatment for any number of aches and pains. Many see magnet therapy — the placement of powerful magnets on the body to bring about relief from pain — headed in the same direction. For now, it remains the newest and trendiest practice in the burgeoning alternative-health-care field.

BY ASHLEY JUDE COLLIE

Fifty-eight-year-old golfer Jim Colbert is one of magnet therapy's biggest fans. The all-time top money winner on the Senior PGA Tour, with earnings of more than $1 million in 1998, he didn't enjoy success until he began wearing magnets to relieve his chronic back pain three years ago. "I've had back problems since I was fifteen," says Colbert. "I thought I was going to have a very short career. But wearing magnets around my waist while I play has kept my back from spasming, and I've been able to play quite well. They've really been a career saver."

Testimonials also come from the smash-mouth world of pro football, where Miami Dolphins director of rehabilitation Ryan Vermillion treats at least half of the players with magnets, including quarterback Dan Marino. When the future Hall-of-Famer was recovering from a broken ankle two years ago, Vermillion suggested Marino strap on some magnets. The area healed quicker than expected, and Marino missed only two games instead of much of the season. I think it was a combination of good surgery on a healthy athlete and the magnets," Vermillion says of Marino's quick convalescence.

Lindsay Davenport, one of the top women's tennis players in the world, underwent five hours of magnet therapy on an achy elbow before the Australian Open in January. "My arm has not hurt one bit since then," she told a reporter.

But it isn't just athletes who are swearing by magnets. Long Island native Marlynn Chetkof is a potter who suffered severe back pain from long hours at the wheel until she was introduced to magnets in 1993. The youthful fifty-seven-year-old now sells Russell Biomagnetic products, saying, "DO yourself a favor and try magnets instead of taking painkillers or just living with pain."

This current attraction to magnets has its skeptics. Dr. William Jarvis, a professor of public health and preventive medicine at California's Loma Linda University and the former president of the National Council Against Health Fraud, has studied the effects of magnets for the American Cancer Society and scoffs at the new-wave remedy's claims. "Any doctor who relies on clinical impressions, on what they think they see, is a fool," says Jarvis. "And anyone selling magnets or making unsubstantiated claims is a quack."

Other detractors are less vehement. Says Dr. Tim Lamer, chairman of the Mayo Clinic's Pain Management Division in Jacksonville, Florida, "In general, people with pain problems who are hoping for relief are vulnerable to a placebo response.

The Food and Drug Administration has no official position on magnets or magnet therapy, and hasn't approved them as a medical cure or device. But despite the lack of government approval, sales of magnets are skyrocketing. In fact, estimates have the U.S. market approaching *$150* million annually. Available on the Internet and in golf and sporting-goods stores in addition to doctors' offices, magnets come in various shapes and forms — wristbands; insoles; seat pads; leg, shoulder, and back wraps; mattresses; and even sleeping pads for pets.

So what's so magnetic about magnets, an item we normally use to stick grocery lists and family photos to the fridge?

Some proponents suggest that magnets work with the principles of shiatsu massage. Others say the iron in red blood cells responds to magnetic fields. Still others point to a magnet's ability to create an alkaline reaction in the body that is believed to allow metabolic processes to function normally.

Dr. Marko Markov, who heads up New York-based Magnetherapy Inc.'s research and development division, offers a more allegorical explanation. "By enhancing blood circulation," he says, "we deliver three repairing components: oxygen, ions, and nutrients. It's like we bring injured cells to a cocktail party — here's the food, drink, and sweets. We bring these components to injured tissue, and the cells pick up what they need." Adds Bill Roper, the CEO of Magnetherapy, "Magnets don't cure or heal anything. All they do is set your body back to normal so the healing process can begin."

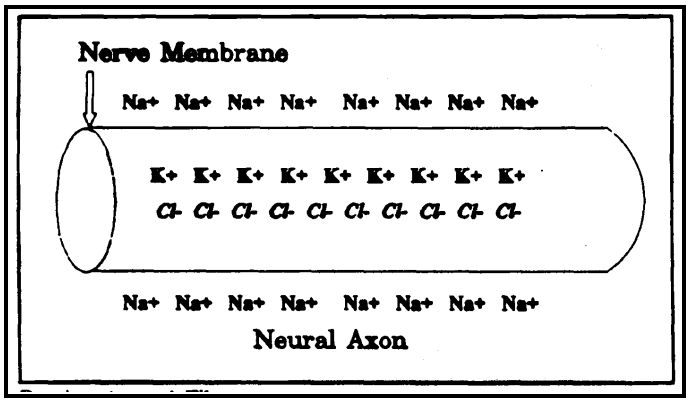
The most famous study done on magnets was performed at Houston's Baylor College of Medicine in 1997. A double-blind study — neither the doctors nor the patients knew who was given the placebo — showed that seventy-six percent of post-polio patients who wore magnets had less pain. The January issue of the *American journal of Pain Management* reported on another double-blind study that said small magnets could reduce the severe pain of diabetic neuropathy, nerve damage produced as a side effect of diabetes. An ongoing study at the University of Virginia is testing magnets on sufferers of fibromyalgia, a painful muscle condition. The Universities of Miami and Kentucky are studying them in relation to carpal tunnel syndrome, while Boca Raton plastic surgeon Dr. Daniel Man is analyzing magnets' effect on his postoperative patients.

Some people are so convinced of magnets' potential they insist magnetic therapy will replace pharmacological therapy within the next decade. "People are fed up with the 'let's wait until there's something wrong' philosophy," says Clifton Jolley, the spokesman for Nikken, an international well-ness company that markets its magnetic products for rest and relaxation. "They want to take charge of their own health care."

ASHLEY JUDE COLLIE is an internationally published journalist who has appeared on CNN and has been a foreign correspondent for *The Washington Post.*

Neurological Effects of the New Magnetic Therapeutic Pads

Clinical studies have indicated a possible mechanism for the remarkable ability of the new magnetic therapeutic pads to relieve pain. As we are all aware, the transmission of physical pain is strictly a function of the nervous system. The human body contains an extensive network of nerves which collectively make up our five senses, allowing us to perceive the physical around us and alerting us to conditions which are harmful to our bodies through the perception of pain. So as unpleasant as it might feel, pain plays a very important role in our survival. However, millions of people suffer needlessly from pain that has no apparent cause. Such a condition is clinically known as ***Chronic Pain Syndrome.*** To understand why this happens we must first understand how pain is transmitted by the nerves.



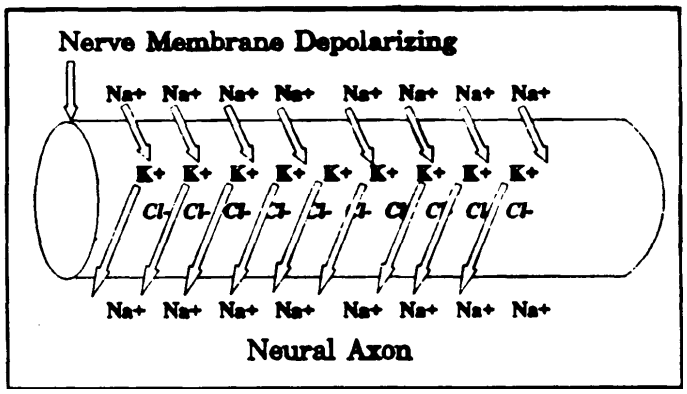
Resting Axonal Fiber

The nerve itself can be thought of as an electrochemical device that responds to external stimulation by producing minute electrical signals which initiate a series of chemical and electrical changes between the inside and outside of the nerve. These changes occur in a chain reaction which travels down the long nerve stem called the **axon connecting to other nerves until it finally reaches the brain.**

The figure above shows the axon in it normal, unstimulated state. Notice that sodium ions (Na•) are concentrated just outside the axon while potassium (K+) and chloride (G) ions are on the inside.

The separation of these electrically charged particles by the nerve membrane produces a voltage of about 70mV (70 thousandths of a volt) between the outside and inside of the nerve. This voltage is called the **resting membrane potential.** As long as the resting potential is present pain cannot be transmitted. But when a sufficiently strong stimulus is imposed on the nerve a change occurs as illustrated in the next figure. Suddenly the nerve membrane becomes more porous and the Na' ions rush in while K+ ions move out.

This exchange of ion concentrations causes a change in the electrical voltage across the nerve. The resting potential suddenly drops from 70mV to OmV. This is called ***depolarization.*** But the process doesn't stop here. The section of nerve just ahead of the depolarized area responds to this change and also becomes depolarized while mechanisms in the nerve cause the area that was just depolarized to return to its original state. This is



Depolarizing Axonal Fiber

Called ***repolarization.*** This chain reaction can be described as a pain impulse that travels from its point of origin to the spinal cord and then to the brain where it is finally recorded as pain. As involved as this might sound, the whole process takes place in less than a split second!

A critical point to understand is that the pain impulse process is an all or nothing event. Once the resting potential drops to 55mV, the threshold potential, the whole chain of events is started and nothing can stop it!

Think for a moment what could happen if a nerve were sluggish and didn't maintain a healthy resting potential of 70mV. Let's say it produced only 6OmV across its membrane. That means a drop of only 5mV would start the whole pain process. The slightest stimulus would cause pain and that dreaded condition of chronic pain

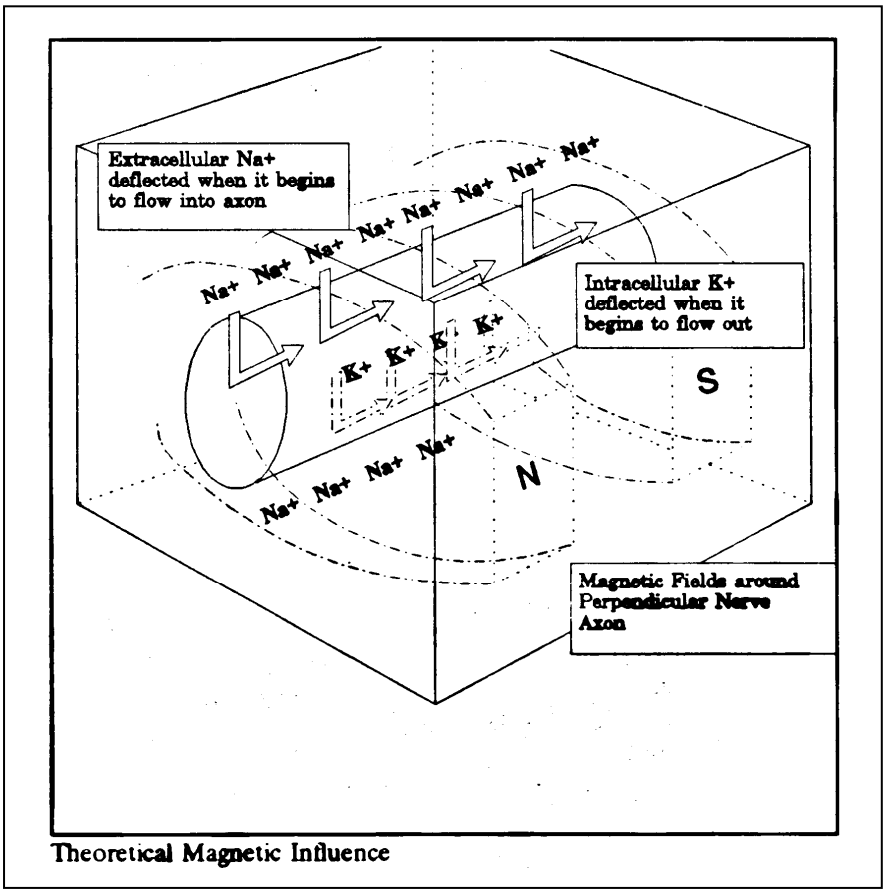
would now exist. Although this is only one possible explanation of a very complicated condition, it does bear a lot of weight and is supported by clinical observations on the effects of magnetic therapeutic pads. Dr. Peter Kokoschinegg of the Institute for Biophysics and Ray Research in Vienna firmly believes in the neurological effects of static alternating magnetic fields. In his report **The applications of Alternating Fields in Medicine** he states *...the magnetic field apparently reduces the neural depolarization of the slow C-fibers by shifting the membrane resting potential. The entire excitation of pain is thus influence and the subjective perception of pain changed.* Dr. Kokoschinegg successfully treated over 200 patient conditions using magnetic therapeutic pads.

In order to understand how the magnetic pad might influence the nerve consider that like the blood, nerves are also replete with ions. A properly positioned magnetic field would affect the movement of these ions and hence the electric field established between them.

In fact, anytime a magnetic field passes through ions in a direction perpendicular to their movement, the Hall Effect takes place and a Hall Voltage is produced. This voltage could add to the nerve's resting potential and raise it to a higher level making it less likely to depolarize. Also, the deflecting action of the magnetic field on the ions could make it more difficult for the ions to pass through the nerve membrane. This concept is illustrated below.

Either way, or perhaps a combination of both, tends to prevent nerve depolarization and hence stops the cycle of pain transmission.

Ultimately, though, however the magnetic pads work, they do work! And, like aspirin, various theories exist which try to explain their effectiveness. I believe that the theory presented in this paper is a very plausible one and I hope it lends some insight into a very complicated subject, pain.



Theoretical Magnetic Influence

1. **Facts on Electromagnetic Radiation**. George S. Lechter. Safe Technologies Corporation, Needham, MA 02194. 1991
2. **Facts on Electromagnetic Radiation**. et. al.

Magnetic Energy - How Safe Is It?

Today, a growing concern is emerging which links cancer to electromagnetic fields, more commonly known as EMF. This concern is supported by increasing clinical evidence that certain EMF radiation has accelerated cancer growth in laboratory animals' and statistical studies showing an increased incidence of cancer among humans in areas exposed to higher than average amounts of EMF, especially the type coming from electric power lines.' Lately, the major TV news networks have been reporting daily about this alarming connection between EMF and cancer.

In light of the startling new evidence, many people understandably are asking, *How safe are the magnetic fields used in magnetic therapy?*

To answer that question, a distinction first needs to be made between magnetic fields and electromagnetic fields. As the name implies, electromagnetic fields contain a magnetic field and an electric field. One cannot exist without the other in EMF radiation. A purely magnetic field, on the other hand, is just that, purely magnetic. There is no electric field present at all. That's because the magnetic field, in this case, is not being produced by electricity as with EMF, but by the alignment of atoms that have their electrons all spinning in the same direction. A prime example of pure magnetism is a permanent magnet.

Further, EMFs are **traveling waves *of* energy.** All traveling waves of energy are created by fields that periodically change their polarity. (+-+-+-+-+- *etc.).* In other words, they all have a frequency. In contrast, pure magnetic fields are static, meaning they have **no frequency.**

These differences are important to consider because if EMF is harmful, then it is reasonable to ask, which component is harmful? Is it the electric field? Is it the magnetic field? Or is it a combination of both? Scientists, at present, don't really know.

If it's the electric field, for instance, then of course static magnets are safe since they have no electric field. If it is the magnetic field that is the culprit, then consider that the magnetic field from EMF is an alternating magnetic field operating at a continuous frequency. The constant bombardment of living organisms with this type of energy is strictly a man made phenomenon created without regard for biological life. Although EMF play a vital part in the functioning of modern day society, their interaction with biological life is wholly unnatural.

In contrast, pure magnetism is a static or stationary field and is entirely natural. The earth itself is basically a very large static magnet. Since time immemorial life has existed in a static magnetic field, it is reasonable to assume that it may be harmful **not to have** such a field. In fact, there is considerable evidence to support this assumption.

Dr. Kyoichi Nakagawa, director of the Isuzu Hospital in Tokyo, Japan, wrote an article in the Japan Medical Journal in 1976 entitled, ***Magnetic Field Deficiency Syndrome and Magnetic Treatment.*** In it he attributes a multitude of common ailments, from backaches to insomnia, to the fact that the earth's magnetic field has decreased over the centuries. That, coupled with modern day living conditions which decrease the field even further, contributes to a deficiency of necessary magnetism in the body. He cites several clinical studies which demonstrate how static magnets have been used successfully to treat these ailments where conventional treatments had failed. Dr. Nakagawa firmly believes that the therapeutic use of static magnetism is a necessary tool for healthy living in the modern world.

Dr. Nakagawa is not alone. As the doors of alternative medicine are finally opening in the west, more and more researchers are rediscovering the benefits of natural magnetism and are looking for new and innovative ways of incorporating this benign energy into people's lives. The new magnetic therapeutic pads are one recent and exciting example of this.

Hopefully, the future will reveal even greater breakthroughs in magnetic therapy. As society slowly emerges from years of conditioning that the only approach to good health is through drugs and surgery, let's keep an optimistic view that greater discoveries are just on the horizon.