Multiple Sclerosis Association of America

Multiple Sclerosis and Cooling

Third Edition

MSAA

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THIRD EDITION

Introduction: Multiple Sclerosis

Multiple Sclerosis (MS) is the most commonly diagnosed neurological disorder among young adults. MS is characterized by a disruption of nerve impulses traveling from the brain or spinal cord to other parts of the body, along the nerves of the **central nervous system (CNS)**. Researchers believe that once a person acquires MS, his or her immune system malfunctions and damages or destroys the protective layer, known as **myelin**, in the brain and spinal cord. Myelin can be thought of as the insulation around the body's circuitry. Nerve fibers, called **axons**, may become damaged as well.

When myelin and/or axons are damaged, nerve impulses "short-circuit" before they can complete their journey. **The resulting variety of symptoms may include difficulties with vision, numbness, fatigue, balance, spasticity, bladder and bowel function, cognition, and depression, among others.** Many individuals with MS may experience only a few, while others may experience a number of symptoms. For most, these symptoms are temporary, particularly for the first several years following diagnosis. For more information about MS, its symptoms, and treatments available, **please contact MSAA at (800) 532-7667**, to speak directly to a Helpline consultant or to request additional literature.

Cooling and Multiple Sclerosis

Studies have shown that nerves with damaged myelin are sensitive to changes in temperatures.[1] Researchers note that a rise in temperature may cause a failure in the effective transmission of signals from the brain to the body (nerve conduction), and **a reduction in temperature may allow more signals to be transmitted across the damaged nerve.**

The idea of cooling individuals with MS to alleviate symptoms is not a new one. Several research programs were conducted during the 1950s using cool baths.[2] These studies and many unconfirmed

personal accounts seemed to substantiate the theory that cooling the body may provide temporary symptom relief for people with MS. Unfortunately, **cooling practices such as taking cold baths several times a day and sitting close to air-conditioning are often uncomfortable, impractical, and dangerous,** due to the body's defense mechanisms of shivering and vasoconstriction. The answer to these problems is found in the technology developed for eliminating the physical stress of extreme heat and cold for astronauts in space.

Space Technology Refines Cooling

The National Aeronautics and Space Administration (NASA) developed space suits to protect astronauts from the hazards of space. A space suit, however, will also trap heat inside the suit. To stabilize an astronaut's body temperature, space suits are equipped with an undergarment containing a network of small tubes held against the body. A chilled liquid is pumped through these tubes, removing the body's heat by heat transfer between the skin and the tubes. These garments are known as **liquid-cooled garments (LCG's)**, but are often referred to as "**cool suits**." Cool suits are now used in a variety of industrial and military applications.

The suit pictured above is used in the military.

Known for their expertise with LCG's, NASA scientists continued to refine and adapt this technology for the advancement of biomedical research. These advancements include cooling systems for cancer patients undergoing chemotherapy, children who suffer from HED (insufficient sweat glands), and those diagnosed with MS.

MSAA Advances Cooling Therapy

In 1992, MSAA embarked on a pioneering mission to fund scientific research on the clinical effects of cooling and MS, eventually funding several clinical research studies. This research was conducted at clinics across the nation, including:

- University of California, Los Angeles Medical Center
- National Rehabilitation Hospital, Washington, DC
- Fairview Medical Center, Minneapolis, Minnesota
- University of Washington Medical Center, Seattle, Washington

Along with these studies, MSAA continued to expand its cooling program by purchasing active cooling systems (or cool suits) for in-home use by people with MS. In addition, special clinical cooling systems were placed in several key MS centers throughout the country.

As MSAA and NASA continued to expand the science of cooling and MS, both agencies realized the need to pool resources and accelerate the goal of bringing symptom relief to thousands of people with MS. **On May 23, 1994, officials from MSAA and NASA signed a "Memorandum of Understanding" to establish a framework for cooperative efforts.**

This provided a springboard from which many joint endeavors have been completed. These include national workshops, equipment evaluations, and finally, a national clinical research study funded by NASA, in which MSAA staff played a significant role.

The outcome of this study is summarized on page seven of this booklet. Since that time, MSAA continues to be committed to the advancement of research on cooling and MS.

Summary of Clinical Studies on Cooling and MS

In recent years, cooling as a symptomatic therapy for MS has generated significant interest. This is due in part to the availability of liquid-cooled garments and advances in evaluation techniques. The following research studies and summary quotes are examples of the many clinical trials that have involved cooling.

Effect of Cooling on Physical Performance in Multiple Sclerosis

Dr. George Kraft, principal investigator, and Alan Alquist, research scientist, University of Washington MS Clinical & Research Center, Seattle, Washington (completed in 1996).

Summary Quote:

"Subjectively and objectively, we noticed remarkable gains [for those with] heat-sensitive MS [in their] ability to perform repetitive activities. We believe this may be an important finding for MS patients for it is repetitive motor tasks that elicit extreme local and central fatigue in MS patients."

Enhancement of Cognitive Processing by Multiple Sclerosis Patients Using Liquid Cooling Technology: A Case Study

L.D. Montgomery, R.W. Montgomery, Y.E. Ku, Lockheed Martin Engineering & Sciences Company; and NASA Ames Research Center, Moffett Field, California (completed in 1997).

Summary Quote:

"This case study indicates that 'cooling therapy' may be used to temporarily improve the cognitive processing of MS patients."

Temporary Improvement of Motor Function in Patients with Multiple Sclerosis after Treatment with a Cooling Suit

Jergen Kinnman, MD, PhD; Ulf Anderson, MD, PhD; Ylva Kinnman, MD; and Lil Wetterqvist; Department of Neurology, Länssjukhuset, Halmstead, Sweden, Journal Neuro Rehab, 1997, 11, pp. 109-114.

Summary Quote:

"After cooling, ten out of fourteen ambulatory patients and all six wheelchair patients were improved in at least one motor test."

Cooling Garment Treatment in MS: Clinical Improvement and Decrease in Leukocyte Nitric Oxide (NO) Production

E.A.C. Beenakker, MD; T.I. Oparina, PhD; A. Hartgring, MS; A. Teelken, PhD; A.V. Arutjunyan, PhD; Dsci; and J. De Keyser, MD, PhD; Academisch Ziekenhuis Groningen, The Netherlands, Neurology, 2001, 157, pp. 892-894.

Summary Quote:

"Active cooling was associated with a decrease in mean leukocyte nitric oxide (NO) concentration by 41%... NO is a diffusible gas that can enter the CNS and block conduction in demyelinated axons through a mechanism that is not completely understood... Although several other mechanisms may be responsible for the beneficial effect of cooling in MS, results raise the intriguing possibility that a lowering of leukocyte NO production may play an important role."

This study was supported by a grant from MSAA's affiliated organization, Multiple Sclerose Internationaal, Amsterdam, The Netherlands.

A Randomized Controlled Study of the Acute and Chronic Effects of Cooling Therapy for MS

S.R. Schwid, MD; M.D. Petrie, RN (University of Rochester, Rochester, New York); R. Murray, MD, Jennifer Leitch, RN (Rocky Mountain MS Center, Englewood, Colorado); J. Bowen, MD, A. Alquist, PhD (University of Washington, Seattle, Washington); R.G. Pellegrino, MD, PhD, Maria Dawn Milan, RN (Institute for Neurology and Neuroscience Research, Hot Springs, Arkansas); Adam Roberts, Judith Harper-Bennie (Multiple Sclerosis Association of America); R. Guisado, MD (Center for Neurodiagnostic Research, San Jose, California); B. Luna, MS, Leslie Montgomery, PhD, Richard Lamparter, MS, Yu-Tsuan Ku, MS, Hank Lee, BS, Danielle Goldwater, MD (NASA Ames Research Center, Moffett Field, California); G. Cutter, PhD (AMC Cancer Research Center, Denver, Colorado, independent biostatistician); Bruce Webbon, PhD (NASA program manager and principal investigator), Neurology, 2003, 60, pp. 1955-1960.

Summary Quote:

"Although other studies have demonstrated that continuous cooling can promote improvement in neurologic signs over several days, no other study has systematically assessed the long-term benefits of daily cooling, as patients would typically use it. We found no evidence that cooling effects changed over time. Given the lack of side effects observed in this study, modest improvements demonstrated using objective measures of motor and visual function, and persistent subjective benefits, cooling therapy could be considered as a potential adjunct to other symptomatic and disease-modifying treatments for patients with MS."

In addition to these studies, the Institute for Neurology and Neuroscience Research in Hot Springs, Arkansas, has a notable collection of data. This data follows the use of cool suits by individuals with MS for up to five years. In some cases, these individuals have shown a significant increase in various motor functions.

How to Use Active Cool Suits

Active Cooling

The first step to safe cooling is to establish a **baseline temperature**. This is an average of temperatures over at least seven days. This is important because a maximum cooling of two-degrees Fahrenheit from a person's baseline is generally considered safe. A one-degree Fahrenheit drop in a person's temperature, however, has been found to be sufficient for effective active-cooling therapy.

The next step is to **choose a room with a stable and moderate room temperature** (70 to 75-degrees Fahrenheit). Room temperature plays a vital role in effective cooling. If the room is too cool, the body will react against the cooling. If the room is too warm, the cooling suit will be ineffective.

Active suits are always started at room temperature and then the **temperature is slowly reduced during the first 15 minutes.** Most in-home cooling sessions are conducted for **one hour**. They may be repeated with or without exercise (as recommended by one's physician) for **up to three times per day, waiting at least two hours between each session**. These units can also be used with a battery pack, enabling individuals who are heat intolerant to once again enjoy the outdoors.

Cooling therapy, when used correctly, may help reduce some symptoms of MS, including problems with fatigue, vision, spasticity, motor function, and cognition. As with any therapy, not all people receive the same benefit or any benefit at all. Cooling therapy should be viewed as an adjunct to disease modifying drugs, not as an alternative, and should only be done with the approval of a medical professional.

How Passive Cooling Can Help

Passive Cooling

"Passive" cooling refers to cooling with no "active" cooling mechanism, such as a separate pump. Passive cooling can be accomplished through a simple transfer of heat by wearing a garment containing a cooling source.

Evaporation garments include bandanas, skullcaps, and vests. These garments are usually soaked in water, rung out, and occasionally chilled in the refrigerator. As the water in the garments evaporates, they provide limited relief from heat, depending on climate conditions. These garments are less effective in areas with high humidity.

Cooling Bandana

Most passive-cooling garments work by placing **ice or gel packs** into pockets of a vest. This type of system can provide immediate and simple relief from the heat. These vests allow many people with MS to enjoy outside activities that would otherwise be intolerable.

Cooling Collar

Studies have shown that the immediate loss of cognitive and/or physical function can occur due to an increase in either internal (through exercise) or external (room or outside) temperature. Passive cooling can significantly reduce the impact of these factors by providing a simple cooling mechanism. Passive cooling cannot be viewed as a symptomatic therapy, but can be seen as a **valuable preventative tool** to help reduce the impact of heat in

people with MS.

New Technology and MSAA's Cooling Program

MSAA is continuing its efforts to hasten the development of more effective cooling units. MSAA staff is regularly called upon by manufacturers to provide expert advice and relate client experiences. MSAA continues to evaluate the effectiveness of new cooling equipment as it becomes available.

In keeping with our philosophy of delivering quality client services and programs to individuals with MS, **MSAA's Cooling Program offers the free use of active or passive cooling garments and a large range of passive cooling accessories to MSAA clients**, based on suit availability and program guidelines. Physicians and clinics may also apply for the free loan of cooling equipment, providing the items are used in free, patient care or research programs.

For more information on MSAA's Cooling Program, please call (800) 532-7667, ext. 102.
For more details about cooling therapy and research, please call (800) 532-7667, ext. 153.

ENDNOTES

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List of Suggested Reference Works Regarding Neurohypothermia as a Symptomatic Therapy for MS

Please Note: This is not an inclusive listing, merely the editor's choice. **Bold type indicates works of primary importance.**

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