Brain Stimulation via the Tongue: MedStar NRH Studies PoNS™ for Balance Restoration

A new study at MedStar NRH is testing the value of cranial nerve non-invasive neuromodulation (CN-NINM) to improve vestibular function after mild-moderate traumatic brain injury (TBI).

The investigation is evaluating a unique device called a Portable Neuromodulation Stimulator—PoNS™ for short. The device utilizes sequenced patterns of electrical stimulation on the tongue in conjunction with physical therapy as a direct route to the cranial nerves and brain stem.

“PoNS™ has been designed to boost neuroplasticity and regulate the electrochemical environment of the brain,” says Michael Yochelson, MD, MBA, principal investigator of the study and vice president of medical affairs and chief medical officer at MedStar NRH.

“The concept is fairly simple. Stimulation of the trigeminal and facial nerves via the tongue may activate neural impulses directly in the brainstem. With sustained stimulation the impulses can travel throughout the brain and potentially jump-start a cascade of changes to the neural network and create new channels for the release of neurotransmitters,” Dr. Yochelson explains.

PoNS™ is a small device that fits comfortably in the mouth and releases mild electrical stimulation to the tongue. Theoretically, combining neuro-stimulation with physical therapy will boost neuroplasticity and facilitate a better recovery even in patients who sustained TBI more than a year ago.

Continued on page 2.
Brain Stimulation via the Tongue...

“Some preliminary research on a small number of people showed greater improvement in patients who utilized the device,” says Dr. Yochelson. “The hope is this larger clinical trial will help clarify its effectiveness.”

If PoNS™ proves useful in improving function after mild traumatic brain injury it could have wide-ranging appeal. More than 5 million Americans are living with a traumatic brain injury and between 30 and 65 percent of them suffer dizziness and a lack of balance while sitting or standing.

Study Parameters

Patient recruitment for the study is just underway at MedStar NRH and in five other medical centers in the U.S. and Canada. Patients must have suffered a concussion (mild TBI) or moderate TBI, be at least one year post injury and continue to have problems with balance. Participants will be randomized into two groups: During exercise and physical therapy, all groups will use the PoNS™ device; the control group will utilize sham stimulation and the treatment cohort will use the active stimulation protocol.

In a typical 20 to 30-minute PoNS™ session, the patient performs a set of physical exercises, tailored toward their disability. Each of the exercises are paired with specific patterns of electrodes being activated on the PoNS, which in turn stimulate individual nerve endings on the tongue. Over time these nerve impulses from the tongue in association with specific activities help to form new neural pathways—and the patient regains control of that function.

“Patients will participate for five weeks,” explains Rahsaan Holley, OT, study coordinator. “For two weeks, they will complete three hours of therapy at MedStar NRH. Then they will continue to exercise at home for an additional three weeks. They will use the PoNS™ device during their therapy at MedStar NRH and at home. A baseline evaluation will be performed at the beginning of the process, and a follow-up assessment will examine any change in function.”

Potential of Neuromodulation

“If outcomes prove positive, the technique could be used as a treatment tool for multiple diagnoses,” says Dr. Yochelson. “We’ve been examining neuromodulation through the use of external stimulation for some time,” he says. “But now it appears it may be an effective way to change and regulate the electrochemical environment of the brain and enhance neuroplasticity.”

This is the focus of the MedStar NRH Center for Brain Plasticity and Research, Dr. Yochelson notes. “The PoNS™ study is one of a number of investigations examining ways to harness and boost neuroplasticity. We know that it underlies all cerebral learning and training and is the linchpin in recovery for a host of neurological disorders.”
Joint replacement is among the most common surgeries in the U.S., with a million procedures performed annually. That number is expected to grow exponentially in the next two decades—with the number of knee replacement surgeries performed each year alone estimated to reach 3.5 million by 2030.

Among these surgeries will be a growing number of simultaneous and staged bilateral joint replacement surgeries—which is fast becoming today’s preferred choice for many men and women. But bilateral joint replacement comes with some special considerations during post-surgery rehabilitation—a challenge the MedStar NRH Inpatient Orthopaedic Program is especially trained to meet.

“Our program team provides rehabilitation services to more than 200 joint replacement patients a year—and that includes both bilateral replacements, as well as an increasing number of revision surgeries. In fact, as patients live longer revision surgery will become more commonplace. By 2030, it’s expected that 190,000 knee replacement revision surgeries will be performed yearly,” says Robert Bunning, MD, clinical director of the program.

**Comprehensive Care for Complex Cases**

“We have the level of experience that is invaluable for patients—especially those whose recovery is more complex because of chronic health conditions. This high level of skill is particularly important to promote the fullest possible recovery from bilateral joint replacement,” he adds.

“Because we take an integrated, multidisciplinary approach to treatment, we’re very good at managing those chronic health problems—as well as preventing the most serious complications including hip dislocation, blood clots and bowel and bladder issues,” Dr. Bunning says.

“Our team members are sub-specialty therapists with tremendous skill and they have functioned smoothly together for many years. Quite a few of us have worked together for decades.”

While not all patients require inpatient rehabilitation following joint replacement, those undergoing bilateral surgery can benefit from this type of intense care. Patients will spend a minimum of three-hours-a-day in therapy during the average week-long stay.

**Interdisciplinary Team of Orthopaedic Experts**

“The benefit of our inpatient treatment program is our patients’ access to multiple rehab professionals who take an integrated team approach and 24-hour-a-day coverage to diagnosis and manage any medical issues,” says Sherry Mumma, PT, DPT, ATP/SMS.

“We are taking care of the whole patient with a team of orthopaedic experts including physical therapists, occupational therapists, nurses, case managers, recreation therapists, nutritionists and social workers,” she explains.

“Our goal is to maximize function and independence so patients will be safe in their home environment. To reach that goal, we work to increase range of motion, strength and endurance,” she adds.

“We understand that recovery from bilateral joint replacement is complex,” says Jennifer Offutt, OT. “So we work collaboratively on the physical, psychological and pharmacological elements of recovery. That includes building confidence because most patients experience fear of falling, of movement and of pain.”

“The team is very cognizant of the importance of controlling pain and promoting rest to help patients engage in therapy. “Our treatment plan also includes family training, evaluation of patients’ equipment needs—and elimination of barriers they may face in their homes,” Mumma adds. The result is outcomes that exceed national benchmarks.

“We work hand-in-hand with orthopaedic surgeons at a number of facilities such as the Hospital for Special Surgery and with MedStar Health orthopaedic surgeons including Drs. James Tozzi, Evan Argintar, Savyasachi Thakkar, Brian Evans and Mark Zawadsky,” says Dr. Bunning. “These are collegial relationships that truly benefit our patients.”
Expanding Services: MedStar NRH Rehabilitation Network, Clinton

The Clinton, Maryland, outpatient center is expanding services, providing the full scope of orthopaedic-related rehabilitation therapies. The center is staffed by a team of five physical therapists with years of training and experience in treating patients with a wide range of disorders from the cervical spine to the foot, as well as sports injuries.

“Members of the team specialize in foot and ankle injury and post-surgery rehab,” explains Brigitte Henry, PT, DPT, COMT, clinic director. “We also boast a PT with athletic training background, and a certified orthopaedic manual therapist to provide specialty relief for patients with spine and musculoskeletal dysfunctions.”

Patients are often referred by their primary care physician, Henry notes. “But we take self-referrals as well and provide complete orthopaedic evaluations. Most often therapy will resolve a patient’s issues, but we work closely with a team of orthopaedic and neuro specialists when referral is needed.”

The center is conveniently located in the heart of Prince George’s County MD, and serves the entire Upper Marlboro, Clinton, and Camp Springs area as well as close-in Washington, D.C. communities. “Easy parking and no wait times for appointments is a real draw for our clients,” Henry adds. “We also pride ourselves on a great atmosphere in the clinic, creating an overall healing environment.”

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Services
• Arthritis Program
• Falls Prevention Program
• Foot and Ankle Services
• Manual Therapy
• Orthopaedic disorders
• Physical Therapy
• Repetitive Motion Disorder Services
• Spine Dysfunctions
• Sports Medicine Program

Comprehensive Amputee Care: Surgery through Recovery

The newly-developed MedStar Amputee Recovery Program is a system of care to help amputees reach their fullest possible recovery by providing multidisciplinary services that begin before surgery—and continue throughout their rehabilitation. The program pulls together multiple resources to provide patients with seamless and comprehensive care tailored to their individual needs.

MedStar NRH plays a critical role in the programs. Members of the MedStar NRH team provide evaluation of each patient’s rehabilitation needs and begin the process of prosthetics fitting before and immediately after surgery. The Amputee Recovery Program also includes comprehensive inpatient rehabilitation at MedStar NRH and specialized therapy at outpatient centers throughout the region.

A very important element of the program is the Prosthetic Amputee Care Coordinator who serves as a personal guide to patients and families during the first 90 days after amputation. The coordinator acts as a link to services and health care providers, and helps patients successfully navigate through every level of care from surgery—to prosthesis fitting and training. To learn more visit MedStarNRH.org.
Two Memoirs, Two MedStar NRH Stars

**Drew Batavia**

If you met Andrew “Drew” Batavia you weren’t likely to forget him. He was articulate, assertive, and a wheelchair user who navigated his world with a chin control, a keyboard, and a mouth stick. His memoir published posthumously last year tells the story of a man who in 46 years lived a life filled with achievement following a spinal cord injury at age 16.

His book *Wisdom from a Chair: Thirty Years of Quadriplegia* recounts Drew’s impressive resume that includes a law degree from Harvard, a White House fellowship, years of work as an internationally respected disability rights advocate—and a key author of the regulations for the Americans with Disabilities Act.

Along the way, he spent nearly five years at MedStar National Rehabilitation Hospital under the tutelage of Gerben DeJong, PhD. He and Dr. DeJong became a successful team publishing articles and developing proposals to fund rehabilitation research.

On the book’s cover is a drawing his brother Mitchell created at Drew’s request decades ago—a picture of Don Quixote. “But Drew wanted Don Quixote mounted on a wheelchair rather than a horse, facing his mortal enemy, the windmills of injustice.”

Unlike Don Quixote, Drew was successful at defeating his enemy. He was a tireless fighter for the rights of individuals with disabilities. But he was also a man with a wife and children. “He would never want to be idealized,” says Dr. DeJong. “He wanted people to treat him as they treated anyone else.”

**Lauro Halstead, MD**

In his memoir, *An Unexpected Journey: A Physician’s Life in the Shadow of Polio*, Lauro Halstead tells the story of his remarkable life—filled with tragedy, acceptance, triumph and love. At just 18-years-old, Dr. Halstead was hitchhiking across Europe when he fell ill. It was 1954 and the polio epidemic was raging and soon the healthy young college student was very sick very far from home.

His memoir recounts his struggle and recovery—and the decades that followed as he went to medical school and established a remarkable career in rehabilitation medicine. Ultimately he suffered a physical setback that reshaped his future. He diagnosed his own post-polio syndrome and became one of the nation’s top experts in the field. In 1986, he brought the program to MedStar NRH and developed a model of treatment still being used today.

The book is filled with Dr. Halstead’s personal encounters with fascinating people and travel to distant places. Still among the most touching passages of his memoir are those dedicated to his strong friendships and his family. And in the end, the book is an honest and satisfying journey into a life well lived.

Third Generation ZeroG® Installed at MedStar NRH

*MedStar National Rehabilitation Hospital welcomed the latest ZeroG® technology to its arsenal of rehabilitation devices. The Aretech ZeroG® robotic body-weight support system was first installed at the hospital in 2008—the first installation worldwide. It quickly became a keystone of rehabilitation services for a variety of patients with a wide range of neuromuscular and orthopaedic diagnoses.*

The technology provides dynamic body-weight support for a host of functional activities including over-ground walking, sit to stand, getting off the floor, and climbing and descending stairs. The device was developed at MedStar NRH by Joseph Hidler, PhD. Today Hidler is CEO of Aretech, a medical device company.

The latest version of ZeroG® boasts some important refinements. “The new device includes the WaveLink communication protocol as an alternate method of controlling the ZeroG® when there is no Wi-Fi signal,” explains Karen Hidler. Therapists utilize hand-held devices to control the interactive balance programs and games that patients experience. The new tool gives them a safe way to quickly switch connections.

A new dynamic fall recovery system called ActiveAssist adapts the dynamic body-weight support that cushions the fall for patients who may need assistance regaining control. “It compensates for those patients who are too weak to easily recover from a fall—and helps keep them feeling confident,” Hidler says. “And the new system restarts the therapy program automatically—therapists don’t have to restart the training session manually.” In addition, the newest version has been built to support heavier patients, up to 450 lbs.
Preempting Urinary Tract Infection

Suzanne Groah, MD, MSPH, director of Spinal Cord Injury Research at MedStar NRH, has been awarded a $500,000 grant by the Craig H. Neilsen Foundation to create a first-of-its-kind screening tool for urinary tract symptoms among patients with spinal cord injuries. The Craig H. Neilsen Foundation’s funding is dedicated to supporting both programs and scientific research to improve the quality of life for those affected by and living with spinal cord injury.

The grant supports the development of a questionnaire for individuals being treated for bladder dysfunction due to spinal cord injury. “We realized that we needed a patient-centered method to determine the relative frequency and importance of urinary symptoms early—and perhaps by better understanding urinary symptoms in this population, we might better prevent infection,” says Dr. Groah.

“We also understood that an effective self-assessment tool based on patients’ own experiences would be invaluable to the health care management of patients with spinal cord injuries and illness, as well as those with hospital acquired infections and patients with neurogenic bladder as a result of chronic conditions, such as MS,” she adds.

Instead of utilizing a clinician-focused approach to developing patient-reported outcomes, Dr. Groah and the research team focused on soliciting input from patients. Responses to questions about urinary signs and symptoms were elicited from clinicians and patients during separate interviews and focus groups.

“We saw that input solicited from patients was markedly different from existing guidelines that are the result of physician or expert reported information,” Dr. Groah says. “As a result, the instrument we developed has 29 distinct urinary symptoms, which include 13 symptoms identified by clinicians on the guidelines, and 16 new items derived from patients.”

The resulting questionnaire was then validated using a national sample of 300 people living with SCI. “The most endorsed items in our national sample were those that came from patients—and the least endorsed were those derived from clinical guidelines,” she notes.

Next Steps

The urinary symptom instrument will continue to be refined and tested, Dr. Groah explains. “In the end, our goal is to create a useful tool for self-management. It also could be a valuable tool for researchers to increase understanding of urinary symptoms, which will hopefully significantly advance prevention, diagnosis and treatment of urinary tract infection in this at-risk population.”
Jessica Barth: First OT Stroke Net Fellow in U.S.

Jessica Barth, MS, OTR/L, CBIS, is the first occupational therapist in the country to receive a research fellowship from the National Institutes of Health Regional Stroke Trial Networks—Stroke Net. Barth, a research OT with MedStar NRH, is conducting her research under the auspices of the Stroke National Capital Area Network for Research (SCANR)—the regional collaboration between MedStar NRH and MedStar Washington Hospital Center that is one of just 25 NIH Stroke Networks in the nation.

The National Institute for Neurological Diseases and Stroke (NINDS) project is focused on fostering clinical trials to test new ways to treat acute stroke, prevent a second stroke, and help people recover more fully following a stroke.

Barth is one of nearly 90 recipients of Stroke Net fellowships since its inception in 2013, and of just 29 recipients for 2016-17. She joins a rich educational program in the D.C. region that includes five fellowship programs and two adult neurology residencies among SCANR’s five affiliated institutions.

The grant is allowing Barth to devote her energies full time to research. “I had previously spent half of my time in clinical responsibilities,” she explains. “Now as a fellow I can design and execute my own research study.”

Upper Extremity Recovery

Barth’s investigation focuses on upper extremity recovery following stroke. The research study is examining the relationship between movement of the arm during the early post-stroke period and the patient’s perception of arm function later during recovery.

“There hasn’t been much research conducted in the first week after stroke,” Barth explains. “We want to better understand how to correlate early movement to later function—and try to identify which functional measurements immediately following stroke are the best predictors for recovery.”

Patient recruitment has begun in conjunction with MedStar Washington Hospital Center—a Primary Stroke Center that treats more than 1,200 stroke patients annually. During the course of a single year, Barth hopes to recruit 100 patients for the study.

Baseline Assessments, Patient Perception

Barth will conduct baseline assessments of patients during the first week following stroke using a series of standard clinical measures, as well as accelerometry and goniometry.

“Goniometry measures joint movement, while accelerometry measures rotation, direction and force of spontaneous movement,” Barth explains. Spontaneous movement will be tracked with the ActiGraph, a watch-like device worn on the wrist, which patients will wear for between 24 and 72 hours during the first days in acute care.

Thirty-days following their strokes, patients will be interviewed to determine their perception of arm function. Local patients will also undergo clinical assessment at the hospital.

“We think we will be able to identify those measures that are the best predictors of function at 30 days post stroke. This information could help clinicians streamline the assessment process and improve effectiveness and efficiency of care. It may also ultimately help clinicians better determine what type of rehabilitation services will produce optimal results for individual patients,” she adds.

For more information about the study, email Jessica.Barth@MedStar.net.
This issue of New Dimensions showcases some of our latest research projects—investigations to evaluate an innovative new therapeutic device for TBI, create a self-assessment urinary tract symptom screening tool for spinal cord injury, and improve early intervention for stroke.

This newsletter is just one communication vehicle we are utilizing to tell the MedStar NRH story. While we have long had a social media presence, we are harnessing these tools more effectively to ensure we are reaching our colleagues to let them know about the breadth of our research and clinical programs.

We’ve increased our presence on Facebook, Twitter, Google+, Linked In and YouTube. Most recently, we have added Doxmity to our arsenal of networking tools. Please be sure to connect with us so you can keep up with the latest clinical and research developments at MedStar NRH. We will also be sending more e-blasts your way—short informational messages to keep you up-to-date on programs, studies, staff openings and educational opportunities.

In medicine, increasing “connectivity” between researchers, clinicians and patients is the critical key to improving the public’s health. Sharing information and ideas advances clinical practice.

Today information sharing has moved into warp speed—and sometimes this capacity is overused and misused. We understand that bombarding you relentlessly with data is more disruptive than informative. So we are trying hard to be discriminate in our use of social media. We will reach out to you when we have something important to say.

We also understand that connectivity depends on give and take—and hope you will use social media to create a dialogue. Let’s utilize these platforms to our best advantage: To exchange ideas and foster collegial relationships with the potential to impact patient care.