



'Handy' high-tech devices now help stroke patients gain function

► *Uri S. Adler, M.D.*

Let's have a hand for technology—and vice versa. Thanks to advanced research, pioneering devices that improve hand function are bringing new levels of quality to stroke patients' lives. These complex tools, which electronically or mechanically activate muscles that have been paralyzed by stroke, can be highly effective therapeutic modalities as well as assistive devices.

At Kessler Institute for Rehabilitation, stroke patients now have access to two promising new devices to optimize therapy and improve hand functionality, the NESS (Neuro-muscular Electrical Stimulation System) H200 and the SaeboFlex.

For better muscle control

The NESS H200, unveiled last

year by Bioness Inc., is designed specifically for patients with stroke or upper-extremity paresis. The device consists of an exoskeleton that looks much like a splint, which is worn over the hand and forearm. It can be used by all patients with neurological damage to the upper limb, but is most beneficial for those with some degree of hand strength.

Once it is fitted to the individual patient, electrodes in the device are positioned over specific muscles. A separate, microprocessor-controlled activator allows the user or therapist to turn on the electrodes, which stimulate the paralyzed muscles of the fingers and thumb. Repetitive exercises with the product can increase range of motion, strengthen and activate muscles and improve

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Focus on

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Why ‘population-based care’ is more than just a slogan

► *Bruce M. Gans, M.D.*

Successful businesses have a long history of breaking down the customer base into distinct groups. By organizing the people they serve into specific “markets,” companies can better target business lines, maintain client satisfaction and boost product quality.

The same mindset, of approaching “customers” as markets or populations, is now permeating medicine. When I treat a patient in my office, I’m delivering only one episode of care. But when I focus my practice on many patients with similar conditions, I can address them as a population, taking into account their common medical conditions, socioeconomic realities and advocacy needs. I can then begin to harness the power of numbers to enhance the care I give them all.

Many outside forces are now moving the medical community toward population-based care. Insurers increasingly expect physicians to report data on their care of different patient populations. Some of these data may eventually be required for physicians to maintain their board certification.

Legislation now pending in Congress would introduce pay-for-performance strategies into the Medicare program. Physicians would have to reach and report on performance targets for different patient populations—such as the consistent use of anticoagulation treatment to prevent DVT in at-risk patients—to maintain current reimbursement and qualify for additional payments pegged to demonstrated quality.

But implementing population-based care isn’t just submitting to the latest round of insurer and certification demands. When it comes to care delivery, approaching patients as populations offers many advantages for both patients and physicians.

For one, because population-based care gives us experience with many patients whose needs are similar, it can provide greater insight into what works clinically and what doesn’t. That leads us to standardize care to achieve the best outcomes and ensure efficiency and cost-effectiveness. It also encourages us to enhance our expertise with a certain population and even target that market to grow our business.

Population-based care also leads physicians and facilities to connect with formal organizations focused on those patient groups, such as research foundations or consumer and trade groups. Here at Kessler, we work with local chapters of both the Spina Bifida Association and the National Multiple Sclerosis Society, to name just two.

By thinking of patients as populations, we can ourselves identify and spearhead essential advocacy. Years ago, when I was working in Seattle, it became clear that children with cerebral palsy benefited enormously from alternative electronic communication devices—which insurers wouldn’t pay for. My colleagues and I banded together with parents and teachers to create a consumer and professional organization that became a powerful force in securing coverage.

Uniting with patient populations gives us the common ground and numbers we need to improve programs and services. Population-based care enhances our treatment of individual patients and promises to boost the satisfaction of all our “customers”—and our own satisfaction too.

How rehabilitation psychology helps those with chronic pain

▶ J. Bradley Williams, Ph.D.

Chronic pain is a frequent complication for patients who need rehabilitation care. The most common complaints are unrelenting, trauma-related back pain and neuropathic pain. For rehabilitation patients with chronic pain, the discomfort can pose an almost insurmountable barrier to a productive and happy life. Therapy to help patients cope with pain may thus be as important as other disciplines in helping the patient achieve independence and an acceptable quality of life.

Because the body's experience of pain is a complex process, a chronic pain management program requires a comprehensive and multi-pronged approach that includes three crucial elements. One is a medical strategy, to identify opportunities for managing the patient's pain with pharmacology solutions. Another is physical therapy and occupational therapy, to focus on improving the patient's physical status by employing strength, range-of-motion and endurance exercises. The third required element in a good program is psychology, which can play a crucial role in helping patients to manage chronic pain.

It's not just semantics

Most patients at Kessler's pain management center undergo psychological treatment that consists of approximately 12 sessions. The linchpin of the treatment is cognitive behavioral therapy, where the

goal is to gain a proper assessment of the meaning of pain. The idea is to help the patient understand and separate the two main components of pain: sensory and emotional. The emotions that are commonly associated with pain are fear, anxiety and anger—exactly the emotions that can potentiate pain. If we can remove some of the common negative responses to pain, we can often moderate pain levels. Patients are frequently skeptical of what may sound like semantics, but there is a clear physiological explanation for why a cognitive behavioral approach works to reduce pain.

The amplification effect

Pain is an adaptive response that tells the body there is an emergency, in order to initiate a “fight or flight” reaction. The distress from the pain spurs various responses, including the activation of a mechanism in the spinal cord (often referred to as gate control) that actually amplifies sensitivity—for example, sensitivity to pain. If one can learn to be calm in the presence of pain, this amplification effect can be reduced or eliminated.

One technique for reducing this effect is cognitive appraisal of the pain; a person can practice changing his or her experience of pain by learning to separate and eliminate the negative emotional response.

Beyond pharmacological treatments

for pain, one key is eliminating the negative emotional response; another is learning to relax with meditation or slow breathing.



Another key method is teaching the body and mind to relax. Meditation, which quiets the mind by means of chanting, imaging, praying or repeating any simple mind activity, can be an effective relaxation technique. Focusing on one thing, such as breathing, can also help relax the body.

Learning to breathe properly is another approach that is very helpful for reducing pain. The brain is constantly assessing the body for indicators of distress, in order to respond appropriately. Fast, shallow breathing indicates panic, while slow, deep breathing is a sign of deep relaxation.

Individuals with chronic pain often feel that their lives are controlled by that pain. Psychology clearly plays an important role in helping patients gain control over the response to their pain, by teaching patients effective coping skills.

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Tailoring techniques to older patients

Rehabilitation needs can be different for seniors, as this specialist explains

With record numbers of Americans reaching age 65, physicians want to know how to modify the techniques of rehabilitation to treat seniors. Heidi Klingbeil, M.D., director of geriatric rehabilitation at Kessler Institute in East Orange, N.J., recently shared her thoughts on the topic with *Focus on Rehabilitation*.

FOCUS: How is inpatient rehabilitation different for seniors?

KLINGBEIL: When our older patients are hospitalized, we track their medical issues and medications especially closely. There is a range of medical conditions that older people can't tolerate as well as younger ones. The low hematocrit that often results from a joint replacement, for instance, is much more impairing to seniors. The same is true of electrolyte disturbances; older patients are more vulnerable to low sodium or potassium levels.

Seniors require less medication—sometimes as little as half as much as a middle-aged person. We often find geriatric patients admitted with toxic medication levels, particularly of anticonvulsants and narcotics for pain. We look for ways to reduce their medications and we assess their level of deconditioning. In many cases they've grown weaker as the condition that brought them into the hospital became more pronounced. We must know when deconditioning or instability may undermine rehabilitation, and not mistake these signs for a lack of motivation. Communication with family members and primary care doctors is even more important for seniors than for others.

FOCUS: How so?

KLINGBEIL: Very early in the course



For many older people, rehabilitation can improve quality of life dramatically, says Dr. Klingbeil.

of hospitalization, we establish contact with family members to let them know what may be involved at discharge. Is the patient going to be a guest for few weeks, such as after a joint replacement, or is this a prolonged and potentially unchanging situation, like a serious stroke?

We also communicate much more extensively with older patients' primary doctors. After discharge, a psychiatrist may remain as one of seniors' principal physicians, troubleshooting functional and pain problems before they become impairing.

Many times we can help identify circumstances in which patients need a rehabilitation program rather than surgery. Spinal stenosis is a good example. Most MRIs of older spines display some degree of spinal stenosis. But clinically the patient may clearly be suffering from degenerative disc disease, so that surgery is of predictably little value.

FOCUS: What problems bring seniors to outpatient rehabilitation?

KLINGBEIL: Typically pain, such as in the lower back, knees or hips. Or they may have trouble rising from a chair, or inflexibility that makes it hard for them to get into a car or a

bathtub. Osteoarthritis is common in this age group, as are postural and gait problems that predispose patients to falls. All of these are very treatable.

FOCUS: How does outpatient rehabilitation differ for seniors?

KLINGBEIL: I treat many older patients' conditions as emergencies. If they have trouble standing or walking, that can quickly become a situation where they can no longer live alone. Every rehabilitation issue is a wellness issue for seniors, so I make sure I see them within 24 to 48 hours.

I also take a more aggressive approach to treatment, because any time older patients spend off their feet can lead to a permanent loss of strength. Instead of just prescribing physical therapy for a flare-up of knee osteoarthritis, for instance, I'll inject with steroids as well as start patients on an exercise program.

I'll also modify exercises for older patients to minimize their risk of falling, particularly if they live alone. I recommend exercises they can do in a chair or on a carpeted floor.

FOCUS: What is the most important lesson you try to give senior patients?

KLINGBEIL: As the saying goes, "use it or lose it." Older patients have to stress their balance to maintain function. They have to choose exercise programs that result in some muscle fatigue, and they can't ignore nutrition. Rehabilitation for seniors requires the input of an enthusiastic physician—and a patient who really wants to get something out of it. People should realize that rehabilitation offers them a chance to lead a more enjoyable life.

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The promise of transcranial magnetic stimulation for rehabilitation research and treatment

► *Elie Elovic, M.D.*

Students learn in elementary school that electricity and magnetism are related. In 1985, researchers used this basic fact to develop an exciting tool for studying the brain called transcranial magnetic stimulation (TMS). In TMS, an electromagnet is placed near the skull to induce an electronic current within the brain. Applying an electronic current directly to the brain may have a similar effect, but is painful for the patient. TMS, on the other hand, is well tolerated and has demonstrated its utility as both a research tool to study brain activity and a clinical tool for the management of certain conditions.

As a diagnostic device, TMS can be used to explore brain function in individuals who have sustained a stroke, brain injury or spinal cord injury by evaluating changes in brain circuitry. It may also be employed to study the changes in the brain that result from various rehabilitation therapies. Finally, repetitive TMS may turn out to be useful as a treatment modality for various brain and spinal cord conditions. While repetitive TMS can cause potentially serious complications such as rare induction of seizures or amnesia (the magnetic field produced by TMS can also damage credit cards and watches), diagnostic TMS is safe, with headache or mild localized pain the main side effects.

How TMS works

Transcranial magnetic stimulation allows researchers to stimulate motor, sensory or thinking centers

in the brain, in order to study the affects of neurological disease on motor control systems of the brain and spinal cord. One line of research is under way at Kessler Medical Rehabilitation Research and Education Corporation to find out if vari-

hope to better understand this long-term effect.

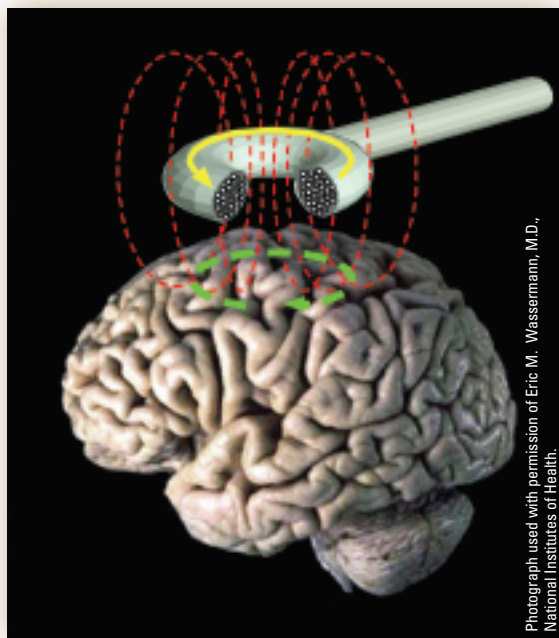
Studying effects on the brain

In the same way, TMS promises to be a potent tool for studying whether other rehabilitation therapies—such as gait training, balance therapy or speech therapy—affect the brain's motor centers. This in turn can provide information on how to change interventions for rehabilitation patients to optimize desired changes to the brain.

Future studies will also see how TMS itself may improve brain function in stroke, brain injury and spinal cord injury patients. Studies have shown that TMS treatments can improve the mood of people with depression, possibly by boosting activity in the brain. For rehabilitation patients, increasing or decreasing electrical activity in the brain may also lead to permanent changes that can improve neurological function.

Because TMS can be used to study activity in motor, sensory and thinking centers, it holds great promise in helping us to better understand neurological injury, assess therapy interventions and even return function for rehabilitation patients.

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Photograph used with permission of Eric M. Wassermann, M.D., National Institutes of Health.

Research is showing that transcranial magnetic stimulation can be a diagnostic and treatment tool.

ous rehabilitation therapies, such as Botox injection, actually change the motor centers of the brain. The injections are used to treat muscle overactivity that results from stroke or other related disorders. Their primary effect is to cause temporary muscle paralysis that generally lasts for three to six months. In some patients, however, Botox produces much longer-term improvement. One possible explanation is that the treatment causes a permanent change in the wiring of the motor centers in the brain. By comparing TMS before and after a Botox treatment, researchers

Making friends has never been more important

► *Bruce M. Gans, M.D.*

A close look at the history of our specialty reveals one key fact: Our field has been built on our ability to collaborate and form coalitions.

Perhaps more than other specialties, we have a pronounced orientation toward groups. We have been trained to think as part of a multidisciplinary team and to view patients as more than just a cluster of medical conditions.

But we've also honed that natural bent by forming alliances to effect change. Even the name of our specialty—physical medicine and rehabilitation—reflects our ability to first collaborate across and then merge two different physician camps to find strength in numbers and in each other's complementary skills.

Reaching out to others

Physiatrists have proved equally adept at forging strong community coalitions. The first generation of rehabilitation hospitals, for instance, was founded by charismatic physicians who worked closely with community leaders. Dr. Henry Kessler was one such visionary, collaborating with community groups in West Orange, N.J., to found the then 16-bed Kessler Institute for Rehabilitation. The same was true of Dr. Howard Rusk in New York City.

We also have an impressive track record of forming coalitions with consumer and advocacy groups, as well as with professional societies and organizations. Those efforts led to the founding of the federal Rehabilitation Services Administration for vocational rehabilitation. They also helped ensure the passage of the Rehabilitation Act of 1973, which created the mandate for that federal agency, and the landmark Americans with Disabilities Act of 1990.

Coalitions are alliances of like-minded organizations around a common goal. Each coalition has its own life cycle, and may be formed to achieve a very specific end: getting a curb cut installed at a specific intersection, for instance, or changing the signal speed of a particular traffic light so a mobility-impaired person can safely cross the street. But many coalitions target more fundamental issues and have longer life spans.

Coalitions can also follow a variety of evolutionary models. Sometimes coalition partners become so close they actually merge to achieve even greater influence.

Now more than ever we need to flex our coalition-building muscle. The challenges

we face demand intense organizing.

Take Medicare, for example.

Or they form to fight off a perceived threat, which is often the case with scope-of-practice issues. Such coalitions may disband once that threat is resolved—or move on to tackle other shared needs.

But coalitions tend to have several factors in common. For one, many are driven by a passionate and committed leader, a person or organization that marshals other resources.

Sometimes a group—such as the American Medical Rehabilitation Providers Association—takes that lead, but it often comes down to one individual. The National Head Injury Foundation (now the Brain Injury Association) is an example where a dedicated advocate became the driving force behind forging an ongoing organization.

Many coalitions have something

else in common: They frequently come together to deal with financial matters, such as funding for service programs or better reimbursement for a group of providers. Or they form to advocate legislation—which likely focuses on directing how funds should be allocated and utilized. For our patients, our push for broader financial resources has led directly to more options and a better quality of life.

Fighting for funding

Now more than ever we need to flex our coalition-building muscle. The challenges we face are as daunting as ever and demand intense organizing. Take Medicare, for example. Physiatry has been collaborating with many consumer and provider organizations to retool the 75 percent rule. We need even broader coalitions to preserve and expand patient access to needed services. Similarly, coalitions to safeguard Medicaid funding are sorely needed as the safety net for some of our most vulnerable patients faces new funding cuts.

And research needs intensive coalition-building efforts as well. A new coalition is now forming that brings together professional and consumer groups, as well as foundations and trade organizations, to secure additional national funding and improve the infrastructure for rehabilitation research. All of us—as organizations, as facilities, and as individual physicians and advocates—need to get behind that effort to advance the one cause we all share: better therapies and better lives for our patients.

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Stroke patients gain function with today's 'handy' high-tech devices

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hand muscle control.

The NESS H200 has demonstrated its value as an occupational therapy option for the outpatient stroke program, and it recently became available to inpatients as well. The device is used to induce repetitive hand exercises that can be programmed for specific intervals, and has proven very effective in most stroke therapy regimens. Patients can also acquire the device to help perform daily activities.

Getting a grasp

Another exciting device is the SaebFlex, made by Saeb, Inc. Unlike the NESS H200, it has no electronic component. Rather, the SaebFlex is a purely mechanical device with an advanced spring-loaded system. The device is placed over the forearm and hand, with springs attached to caps that fit on fingers. This system allows stroke and other neurologically impaired patients to open and close their hands and thereby perform grasp and release activities that would otherwise be impossible. Unlike the NESS device, SaebFlex does not use a control pad. Instead, the user is able to grasp an object voluntarily, and the extension spring system assists in reopening the hand in order to release the object.

SaebFlex is useful for patients with some shoulder and elbow movement; the only hand function required to use the device is the ability to close the affected hand voluntarily, which many stroke patients have. Individuals who are up to 20 years post-neurological-injury have shown improvement in strength and hand function using SaebFlex,



Using electronic or mechanical stimulation, today's devices improve hand function, helping to restore independence and make possible activities that were once out of reach.

which immediately allows patients to perform functional exercises. It can also be used as an assistive device outside of therapy.

SaebFlex has become an important therapy modality in both the outpatient and inpatient stroke programs at Kessler Institute for Rehabilitation. It can be used alone as a primary occupational therapy tool for repetitive exercises. When appropriate for the individual patient, it is also a useful adjunct to constraint therapy, in which the unaffected hand is immobilized and the patient is forced to use the affected hand.

SaebFlex increases the usefulness of the hand, making the constraint therapy more effective and reducing patient frustration. If increased muscle tone makes SaebFlex exercises impossible, botulin toxin or nerve blocks can be employed to let the stroke patient make use of the device.

To help demonstrate the effectiveness of SaebFlex, Kessler is cur-

rently preparing to participate in a clinical study on the new modality.

Preventing problems

Therapy that allows the patient to use the affected hand more effectively can lead to faster neurological return of function. Even in the absence of return, however, the devices can help perform everyday tasks. The products also play another key role. Patients with neurological impairment as a result of stroke are often unable to open their hands voluntarily due to paralysis of some muscles and spasticity of others.

The result is total dysfunction of the hand, which leads to limb disuse. This in turn can result in muscular atrophy, contractures, edema and pain in the limb. Both the NESS H200 and the SaebFlex can help the individual avoid these serious and painful problems.

What's in store for the future

Finally, these pioneering devices also represent a bold new step in the direction of implantable electrodes, which many researchers believe are the future for rehabilitation technology. Eventually, these electrodes will be able to interface with a person's brain to allow patients to stimulate movement by thought alone. Even more exciting, the devices may become adjunct therapies that allow patients to achieve the ultimate outcome: regeneration of the central nervous system.

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Fluoroscopically guided injections provide a nonsurgical option for back pain

► Jeffrey L. Cole, M.D., and Jeffrey R. Beer, M.D.

Spinal injections can bring relief to patients who have failed to respond to less invasive treatments for back pain. They may also be diagnostically useful to localize the primary source of pain caused by herniated disks, osteoarthritis, rheumatoid arthritis and other sources of back misery.

Studies have shown, however, that when injections are done “blind,” as with surface palpation alone, the miss rate can be as high as 30 percent to 40 percent. Utilizing fluoroscopy combined with the injection of contrast medium improves the likelihood that medication is delivered directly to the underlying pain generator, while avoiding sensitive structures. Even with the use of fluoroscopic guidance, complications such as permanent nerve damage or paralysis are possible. Performed in a blind fashion, injections may miss their intended target and cause serious complications in far greater numbers than with the use of fluoroscopic guidance.

Fluoroscopic injections have been available for some time, but refinements in the last decade have made the technique safer and more effective. As a result, more patients with back or neck pain are able to reduce their reliance on pain med-

ications and avoid surgery. The procedure is an important option in Kessler Institute for Rehabilitation’s outpatient program in musculoskeletal rehabilitation. After taking a complete history and physical examination, clinicians tailor a comprehensive treatment plan to each patient. When spinal injections are being considered, radiographic studies play an important role in the diagnostic workup of the patient. Most often, however, physical therapy and oral anti-inflammatory/analgesic medications are the first line of therapy. If these fail, spinal injections of a number of different local anesthetics or steroids may be used, depending on the desired duration of action and other factors.

Lower back pain often responds well to spinal injections with steroids and/or analgesics, but only when the injections are targeted to a specific structure causing pain. Fluoroscopy coupled with the use of a contrast agent may be used to allow physicians to perform anatomically selective diagnostic spinal injections. With the guided injection, needles are accurately placed with fluoroscopic visualization to allow the delivery of a numbing or steroidal agent directly to the proposed pain-generating structure. The patient then keeps a pain diary over time,

with the extent of post-injection pain relief confirming or disproving that the anticipated target was indeed correct. Then, using fluoroscopy again, a therapeutic procedure such as the injection of medications or radiofrequency denervation may be performed. Often, the pain relief is long-lasting, and if not, the procedure is easily repeated.

Fluoroscopy may have far wider applications than spinal injections as well, and Kessler is about to begin studies on fluoroscopically guided joint injections to determine whether the existing “miss rate” of approximately 30 percent seen in some joint injections can be reduced. As spinal injections have grown more common, however, catastrophic consequences have become more frequent nationwide. It is crucial, therefore, that the procedure be done only by experienced clinicians with specialized training in fluoroscopically guided spinal injections.

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