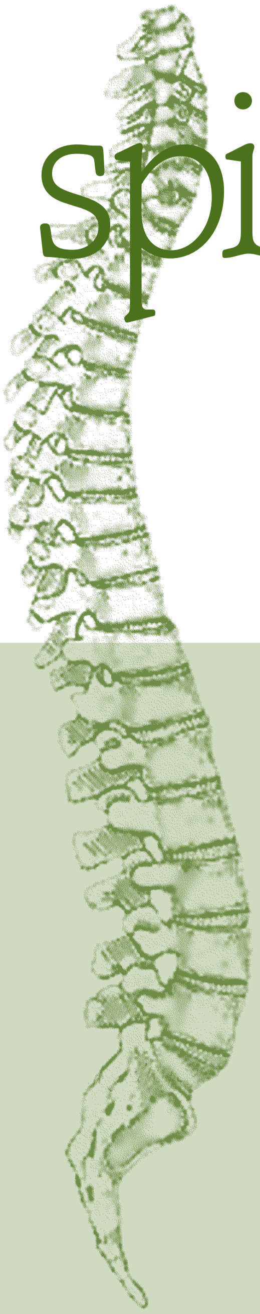

spinal cord injury UPDATE

Department of Rehabilitation Medicine

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INSIDE:

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DEPARTMENT OF REHABILITATION MEDICINE
NW REGIONAL SPINAL CORD INJURY SYSTEM

Spasticity and SCI

By Rina Reyes, MD, Associate Professor, Rehabilitation Medicine, and Director, UW Medicine Spinal Cord Injury Rehabilitation Program.

What is spasticity?

Spasticity is the name for involuntary muscle movement or tightening that is caused by central nervous system injuries like SCI or TBI. Although we don't know the exact mechanism, we do know that the injury to the spinal cord causes a disruption in the very complex nerve circuits of the brain and spine that control reflexive (automatic) muscle activity. When the brain and spinal cord can no longer communicate normally with the rest of the body, the muscles controlled by the injured parts of the spinal cord can become overactive and "spastic."

Most people with SCI (65–78 percent) have spasticity, and many (28–43 percent) report it to be a problem. Spasticity can decrease quality of life and independence, and close to half (43–49 percent) of people with SCI take medications for spasticity. In my practice it's actually more than half.

The severity, location and type of spasticity differ widely from person to person. Symptoms include various degrees of muscle tightness and uncontrolled muscle contractions or jerking. Spasticity can affect any muscle below the level of the spinal cord injury, including arms, legs, bowel, bladder, trunk or neck.

Spasticity does not usually appear right after a person is injured. Rather, there's a period of what's called "spinal shock" where you lose all reflex activity, and the muscles are very flaccid (loose or limp). During the first year or so after injury, muscle reflex activity often starts to build.

Spasticity can come and go during the day and can flare up whenever a new medical problem arises, such as urinary tract infections (UTIs), skin breakdown or fractures.

How can spasticity be good?

Many people can use their spasticity to help with functional activities, such as transfers or hand grip, allowing them to be more independent. Spasticity can strengthen muscles and maintain muscle mass, although there is no evidence that it can preserve bone density. Spasticity can also serve as an early warning system by alerting you to health problems such as urinary tract infections or skin breakdown.

When is spasticity bad?

Muscle tightness and spasms can cause a variety of problems and reduce your ability to be independent. Tight muscles can reduce hand and arm range-of-motion and limit functional abilities. Spasticity can lead to contractures (tightening of muscles around joints) that can make it difficult to walk, transfer, dress or perform personal hygiene and care. Spasms can be painful, disturb sleep, lead to skin breakdown, and cause bladder accidents and poor seating posture. Spasms can pose a safety risk if they are triggered while driving your car or pushing your wheelchair.

Treating Spasticity

Each person's experience of spasticity is unique, and even people with the exact same injury and symptoms may want their spasticity treated very differently. Since many people have a mixture of good, bad and neutral effects of spasticity, the goal for treatment is to

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Tips from the *Wheel World*
...therapist edition

Our tip comes from Elisa Smith, PT, DPT, NCS, who is a physical therapist at Harborview Medical Center and a member of our Consumer Advisory Board. Elisa works with people with SCI on Harborview's inpatient acute rehabilitation unit.

Get a Grip: Wheelchair Handrims

Not all wheelchair handrims are the same, and the type of handrim you use can have a big impact on your comfort and pushing ability. Unlike years past, there are now several options available that you might want to consider.

As a physical therapist who works with SCI inpatients when ordering their first wheelchair, I have tried to become familiar with the options beyond the standard "out-of-the-box" round metal tubes. Since anything non-standard costs more, I wanted to see if the extra expense is worth it. My research led me to wheelchair users, online forums, manufacturer representatives, other therapists and published studies.

The main variations in handrims have to do with shape and coating, both of which affect durability, weight and cost.

Shape

Standard rims are round tubes about an inch or less in diameter (see image on left, below). They are lightweight and "free" (i.e., not an additional charge on a wheelchair order) as long as they are aluminum and do not have any coating. The down side of the round shape is that it can force the wrist and hand into a bent position. Over time this can lead to carpel tunnel syndrome and the associated hand pain, tingling, numbness, and weakness—definitely something you want to avoid!

An alternative shape is the ergonomic ellipse (an elongated circle stretched into an oval—see image on right, below). "Ergonomic" in this case means it is a better fit that causes less strain. These rims are slightly larger and heavier than the round tube and cost between$300 and $400. Still, almost every user I have asked says an ergonomic rim is far more comfortable to grasp and makes pushing easier.

Coating

Uncoated standard rims cause less friction; they rub less and do not leave black smudges on the skin. But less friction also makes it difficult for people with weak hands to get enough traction to press or grasp the rim.

People with a weak grasp usually need extra traction from a partially or fully coated rim, and a patterned or textured coating can add more traction than a smooth coating. Coating material also matters: rubber and neoprene are easier to grip than vinyl, and rubber is less slick when wet than both neoprene and vinyl. Vinyl is less durable; chips and tears in a damaged coating can scrape the hands and are expensive to fix. Saving $100 to $200 up front by buying vinyl may not be worth the lower durability or traction. All the coatings provide some insulation, making them more comfortable in extreme temperatures.

Knobs

Knobby rims—also known as "projection rims" or "quad knobs"— offer extra grasp for users with less hand function. They make me nervous, however, because the knobs can ram into the users' palms when they coast down ramps and potentially cause injury. Likewise, I often see users wrench their thumbs on the projections. Based on my discussions with users and therapists, they are not worth the weight or price.

Gutters

Another design feature of rims is the "gutter," also called the thumb piece, where the thumb rests between the wheel and the rim. This can be solid or flexible and low or high friction, depending on the material. This may help with grip and keeping your hands off the tire. They can add $150 to the price tag and are only available on certain rim products. Users with normal or almost normal hand strength and flexibility can benefit from the ergonomic thumb positioning support. But people with weak or tight hands often do not benefit because they cannot rest their thumbs on the gutter.

Weight

Therapists often worry that ordering expensive rims piles more weight onto a wheelchair, making it harder to push and load into a car. I compared most of the popular rims in my region, and found that all the rims, regardless of shape or coating, weigh between 1.5 and 3 pounds per pair. This is a negligible difference considering the total weight of the wheelchair (usually around 35 lbs.) and the user.

Try Them First!

Finally, test different handrims. Get a referral from your doctor to a wheelchair "Seating Clinic" where a therapist and wheelchair vendor can help you trial rim options and potentially ask your insurance to pay for them. Test them out on ramps, at slow and fast speeds, while dry and wet, and when braking and turning. As you trial rims, check for pain, discomfort, effort, push technique, and speed. This is the best way to help you narrow down your choices. Ultimately, you want the best performance based on your individual needs and financial constraints.

Good luck!

SPASTICITY, CONTINUED FROM PAGE 1

reduce the bad effects, keep the beneficial effects, and learn to live with the rest.

Your health care provider will want to know what your symptoms are, how severe, where in the body, when they occur or get worse, how long the symptoms have been going on, and how they affect your ability to function day to day. In addition, your provider will perform a number of tests that evaluate different aspects of spasticity, such as the Penn Spasm Frequency Score or the Ashworth Score.

Just like the experience of spasticity itself, response to treatment varies widely from person to person, and most people have to go through a period of trial and error. Treatment often involves a combination of medications and non-medication treatments. Your provider may need to work with your insurance company to get more than one treatment covered, since some insurers limit or require pre-authorization for certain medications and treatments.

Oral medications

Baclofen is very good at controlling spasticity but has a number of common side effects, including sleepiness, sexual dysfunction, and dizziness. For some people, the amount of baclofen they need to control their spasticity causes intolerable side effects.

Clonidine is effective but can lower blood pressure and heart rate. **Tizanidine** is in the same class of drugs but is newer and carries a lower risk for developing low blood pressure. There is a small risk for liver dysfunction and blood count abnormalities, so regular blood monitoring is needed while on the drug. It can also interact with ciprofloxacin, an antibiotic commonly used to treat urinary tract infections.

Dantrolene was the mainstay of spasticity treatment for many decades, along with diazepam. It can be mildly sedating, but the primary concern is the risk for liver toxicity. You should be on the lowest effective dose and follow the liver testing schedule.

Benzodiazepines (such as Diazepam) are used for many conditions, including seizure disorders, anxiety or sleep problems. It is as effective as baclofen for spasticity, but causes greater sleepiness, confusion and fatigue. The risk for developing tolerance and physical dependence make this a treatment used only minimally and at night for people whose spasticity keeps them from sleeping.

Medical Marijuana (Cannabis)

Many people with SCI use marijuana to help manage their spasticity. To learn about how it works, what the risks and benefits are, and the legal issues, refer to the SCI Forum presentation on Medical Marijuana and SCI by Dr. Greg Carter at ***http://sci.washington.edu/marijuana***.

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> *Each person's spasticity is unique, and even people with the same injury may need different treatment.*

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Blocks and Injections

Blocks and injections are a way to treat localized—not widespread—spasticity without causing the system-wide side effects like sleepiness or confusion that come with oral drugs.

Phenol is a drug that chemically destroys the peripheral nerve involved in the reflex loop causing spasticity. Nerves in the peripheral nervous system outside the spinal cord are able to regrow themselves, so the effect of phenol injections is temporary. It is used in nerves that have very little sensory component in order to avoid causing pain. Injecting phenol requires electrical stimulation and precision to find the exact injection site in the muscle.

Botulinum (botox) is a neurotoxin that can be injected into the spastic or overactive muscle to cause temporary paralysis or weakening of that muscle. It is easier and faster to administer than phenol but more expensive and therefore harder to get covered by insurance companies. Injections need to be repeated about every three months, and careful dosing is needed because over time it can become less effective.

Surgical treatments

The **Intrathecal baclofen** pump is a surgically implanted system used to control spasticity by infusing baclofen directly to where it is needed—into the intrathecal space inside the spinal canal that contains the fluid that bathes the spinal cord. This method solves the problem of side effects from taking oral spasticity medications because a much smaller dose is needed. See the SCI Forum presentation on intrathecal baclofen at *http://sci.washington.edu/info/forums/reports/intrathecal_baclofen.asp*.

Other surgical options that cut nerves in order to interrupt the nerve circuit causing spasticity (selective dorsal rhizotomy, myelotomy, neurectomy) are irreversible and usually considered only when less invasive methods are not successful.

What treatments are best for you?

Discuss with your health care provider:

- What are your goals for treating your spasticity?
- How important is it that the treatment can be reversed or stopped?
- What are the possible short-term and long-term side-effects of each treatment?
- Do you have other health conditions that would influence the treatment choice?

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This article was adapted from the Spinal Cord Injury Forum "Spasticity and SCI: The Good, The Bad, and the Not-So-Ugly" presented on January 13, 2015.

Watch the video and find more resources about managing spasticity at:
http://sci.washington.edu/spasticity

Brush Up on Your Wheelchair Skills!

New Video Series Shows You How

Are you comfortable navigating curbs, bumpy terrain, ramps, potholes and tight spaces in your manual wheelchair? Would you like to learn new manual wheelchair skills or get better at the ones you already use?

A new series of short videos that teach essential manual wheelchair skills has been produced through the SCI Empowerment Project within the University of Washington Department of Rehabilitation Medicine. Funded by the Craig H. Neilsen Foundation, the SCI Empowerment Project is designed to foster healthy aging after SCI and reduce SCI survivors' vulnerability to medical problems that can decrease their independence and quality of life as they get older.

The project is directed by Rina Reyes, MD, associate professor and medical director of the UW Medicine SCI Rehabilitation Program. "There is a clear need for healthy living strategies that has emerged from the growing recognition of the unique consequences of aging on people with SCI," said Reyes. "We are very grateful to the Neilsen Foundation for this opportunity to create new resources in this area. This video series targets promotion of proper wheelchair skills to preserve long-term shoulder health and prevent falls." Learn more about the SCI Empowerment Project at *http://sci.washington.edu/empowerment.*

The videos were created in response to a need rehab therapists and clinicians increasingly see with today's short inpatient rehab stays. "People with spinal cord injuries often have minimal exposure to essential wheelchair skills during therapy. Being able to confidently and independently wheel around the home and community is becoming a lost art," said Elisa Smith, PT, DPT, NCS, a physical therapist on inpatient rehab at Harborview Medical Center. "We want to instill hope and excitement in people by showing them a range of techniques performed by a user with a recent spinal cord injury. This can mean the difference between being home bound, depending on caregivers, and getting back to full life." Smith researched and wrote the video scripts and also co-stars in the videos.

Volunteer talent Josh Hancock (see photo, left), who has paraplegia, stars alongside Smith in these videos. "Josh has great technique and was very enthusiastic about helping with this project," Smith said. "You can see it come through in the videos."

More videos are in the pipeline. Learn about them as soon as they are released by signing up for our email announcements: subscribe at *http://sci.washington.edu/subscribe* or send an email request to *scirehab@uw.edu.*

Wheelchair Skills Video Series

Video 1: Introduction to Wheelchair Skills
Video 2: Wheelie in Place
Video 3: Wheelie Pop-Ups
Video 4: Forward in a Wheelie
Video 5: Grass to Sidewalk
Video 6: Turning in Tight Spaces
Video 7: Wheeling Across Grass
Video 8: Managing Potholes
Video 9: Crossing Raised Obstacles
Video 10: Down a Ramp in a Wheelie
Video 11: Curbs

Find them at
http://sci.washington.edu/empowerment/videos.asp

Josh Hancock pops a wheelie, one of the essential manual wheelchair skills described in the new Wheelchair Skills Video series from the UW Department of Rehabilitation Medicine.

These and all our videos can be watched on the Northwest Regional SCI System YouTube channel:

youtube.com/uwspinalcordinjury

Spasticity: Real Life Stories

Like most aspects of spinal cord injury, everyone's spasticity is unique, and it usually takes some trial and error and combination of treatments to arrive at a strategy that works. At our February 2015 SCI forum, four individuals with SCI shared their experiences managing spasticity. Watch the video of their entire discussion at *http://sci.washington.edu/spasticity-part2*. Here are some excerpts.

Kenny (C3-4 complete injury, 2004)

My spasticity started up around three or four months after injury. I get pretty good spasms in my arms and legs in the morning and afternoon. And when I get into bed at night my legs can "river dance" and start kicking all over the place. I was up to the maximum dose of oral baclofen about eight months after injury, so I started supplementing with tizanidine. I have pretty much stayed with this regimen for the last 10 years, and for the most part my spasticity is under control. I take my meds at 10 am, 4 pm and 11 pm. My spasticity starts building back up as a dose wears off, but as soon as I take my meds I'm pretty much under control. It makes me a little sleepy, but that only lasts five or 10 minutes. I have found that doing regular range of motion also lessens the spasticity. One benefit of my spasticity, however, is that it can help me cough, which has come in handy when I get a cold.

Ian (C1 complete injury, 2010)

My spasticity has been pretty strong since about a year after injury and tends to be very violent. I get spasms throughout my arms, chest and neck that can be triggered by simply rolling over a bump or carpet edge—my arms will fly out and my head will lurch forward. I take oral baclofen three times a day but also use some medical marijuana, which has proven quite helpful. I take it at night so I don't have to deal with the haze of the high during the day, and it helps me sleep. And the next morning my spasms are minimal. Since the VA will not write a prescription for medical marijuana, my chiropractor recommended a physician to prescribe it. Then it was a matter of finding a dispensary that was knowledgeable and helpful. There are a few items that work consistently for me, but I'm still trying things out. It can be hit-or-miss, since dosing isn't regulated. The product I use is like a tootsie roll. I can only ingest edibles; I can't smoke or vape. (Ian uses a ventilator full time.) Range of motion exercise helps reduce my spasticity, too, as does using my RTI bike (stationary exercise bike powered by functional electrical stimulation technology).

Brian (C6-7 injury, 2010)

My spasticity started to develop about two months post injury. It kept increasing no matter how much medication I took. It got to the point where I was taking a full dose of (oral) baclofen, tizanidine and dantrolene, and it still wasn't working. My spasms were so bad I couldn't transfer without kicking my chair all over the place, and if I twisted the wrong way I'd go over backwards. I needed help doing just about everything. At first the baclofen pump was unappealing because it's so invasive—having a big chunk of metal in your gut and a catheter wrapped around inside your body and going into your spinal column. But at a certain point, about a year after injury, I realized it was necessary if I wanted to have any independence. And the pump completely changed everything for me. I started driving and really taking control of my life. I am completely independent. It took a while to get the dose right, slowly building up over about a year until I got to my current dose. I still have some spasms—I'm not a wet noodle —but I'm not bouncing around and flying out of my chair anymore. It's a matter of finding that sweet spot, which is different for everybody. In my case, I have a continuous infusion at a flat rate with a spike every four hours. That's what really works for me. Also, I've found that staying as active as possible really helps. My spasticity builds up when I sit still. So I hand cycle, play on the Seattle Slam Wheelchair Rugby team, lift some weights, and get out and push around the block. It all helps.

Aditya (C4-5 incomplete injury, 2002)

My spasticity became most noticeable five or six months after injury. The amount of oral baclofen I needed to control the spasticity turned me into a zombie so that I couldn't really function. Tizanidine also completed sedated me. Meanwhile the spasticity was throwing me out of my chair during transfers. I was having trouble holding things, and the extra tone made me rigid and affected my posture and breathing. The worst was getting woken up three or four times a night with violent spasms. After trying all the possible oral medications, I finally had baclofen pump surgery. I had quite a few wound problems related to the surgery site, which have now resolved. My spasticity has calmed down, but it's not completely controlled. It's not a simple story but definitely the pump has made a huge impact in terms of my mobility and independence and not being woken up four times a night. Regarding any benefits of my spasticity, the increased tone in my hands is actually quite helpful for picking things up or gripping things.

Watch the video: *http://sci.washington.edu/spasticity-part2*.

literature review

The articles previewed below were selected from a recent screening of the National Library of Medicine database for articles on spinal cord injury. In the judgment of the editors, they include potentially useful information on the diagnosis or management of spinal cord injury. You may obtain copies of the complete articles through your local medical library or from UW Health Sciences Library Document Service (http://www.lib.washington.edu/ill).

PAIN

The mechanism of neurofeedback training for treatment of central neuropathic pain in paraplegia: a pilot study.

Seven individuals with paraplegia and central neuropathic pain (CNP) participated in this study investigating the effect of neurofeedback training on pain reduction. Neurofeedback is a type of biofeedback in which participants are given information about their brain activity in a visual or auditory form and learn how to change their brain activity to reduce pain. Participants received between 20 and 40 treatment sessions. Six out of seven participants achieved short-term immediate reduction of pain during neurofeedback training. The study found that neurofeedback training produces both immediate and longer term reduction of CNP along with a measurable short and long term modulation of cortical activity. Controlled trials are needed to confirm the beneficial effect of this neurofeedback program on pain.

Hassan MA, Fraser M, Conway BA, et al.
BMC Neurol. 2015 Oct 13;15(1):200.

Capsaicin 8% Patch for Central and Peripheral Neuropathic Pain of Persons with Incomplete Spinal Cord Injury: Two Case Reports.

The capsaicin 8% patch is a Food and Drug Administration-approved treatment for neuropathic pain in postherpetic neuralgia (nerve pain due to damage caused by a virus) and has been effective in human immunodeficiency virus (HIV)-autonomic neuropathy. A retrospective review was conducted on the effects of the patch in two individuals with SCI and neuropathic pain that did not improve with standard treatments. Two weeks after application, both individuals reported complete pain relief. Average onset of relief was 4 days, and average duration of relief was 197 days, requiring only one to four applications per year. This paralleled findings reported in postherpetic neuralgia and HIV-autonomic neuropathy trials. The capsaicin 8% patch is a promising therapeutic agent for neuropathic pain in SCI.

Trbovich M, Yang H.
Am J Phys Med Rehabil. 2015 Aug;94(8):e66-72.

BACLOFEN

Intrathecal versus Oral Baclofen; a Matched Cohort Study of Spasticity, Pain, Sleep, Fatigue and Quality of Life.

Sixty-two individuals who had been treated with intrathecal or oral baclofen for at least 1 year completed surveys measuring spasticity, pain, sleep, fatigue and quality of life. Participants included 38 individuals with SCI, 10 each with cerebral palsy and stroke, and 4 with multiple sclerosis. Average duration of intrathecal baclofen or oral baclofen treatment was 11 and 13 years, respectively. Participants receiving intrathecal baclofen had significantly fewer and less severe spasms than those receiving oral baclofen. There were no significant differences in pain, sleep, fatigue and quality of life between groups. The benefits of intrathecal baclofen must be weighed against the risks of internal pump and catheter placement.

McCormick ZL, Chu SK, Binler D, Neudorf D, et al.
PM R. 2015 Oct 20.

PERIPHERAL ARTERIAL DISEASE

Peripheral Arterial Disease and Spinal Cord Injury: A Retrospective Nationwide Cohort Study.

This study compared the risk for peripheral arterial disease (PAD) in 42,673 individuals with SCI and 170,389 matched controls without SCI. Persons with SCI had a significantly higher risk of PAD than individuals without SCI, and those with diabetes were at the highest risk. Furthermore, lumbar, sacral, or coccygeal spine, and multiple spine SCI were significantly associated with an increased risk of PAD. Future studies should focus on modifying risk factors to reduce PAD risk among individuals with SCI.

Su TW), Chou TY, Jou HJ, et al.
Medicine (Baltimore). 2015 Oct;94(41).

BLADDER

Long-term complications of continent cutaneous urinary diversion in adult spinal cord injured patients.

Continent cutaneous urinary diversion (CCUD) surgeries were performed on 29 individuals with SCI who had been unable to perform intermittent self-catheterization (ISC). Urodynamic parameters improved and, at last follow-up, 100% of patients had a catheterizable continent stoma and 96% had urethral continence. An improvement of quality-of-life was reported by 90% of patients. In this study, CCUD allowed these patients to keep ISC as a voiding pattern and to be continent without any appliance. The main complications were related to the tube and to bladder enlargement; thus, annual monitoring is needed.

Perrouin-Verbe MA, Chartier-Kastler E, Even A, et al.
Neurourol Urodyn. 2015 Sep 23.

UPPER LIMB

Ultrasonographic Median Nerve Changes After Repeated Wheelchair Transfers in Persons With Paraplegia: Relationship With Subject Characteristics and Transfer Skills.

The thirty wheelchair users who participated in this study had been injured for at least 1 year, used a manual wheelchair for more than 40 hours per week, and could complete transfers independently within 30 seconds without use of their legs. Participants completed questionnaires, underwent physical exams and ultrasonography of the median (wrist) nerve, and had their transfer technique evaluated using the Transfer Assessment Instrument (TAI). An acute increase was observed in the median nerve cross sectional area at the pisiform bone after repeated wheelchair transfers. Changes were greater in persons with higher body weight and in persons who did not perform certain transfer skills correctly (according to the TAI). It is possible that these factors contribute to chronic injury and possibly carpal tunnel syndrome.

Hogaboom NS, Diehl JA, Oyster ML, et al.
PM R. 2015 Aug 8

Nerve Transfers to Restore Upper Extremity Function in Cervical Spinal Cord Injury: Update and Preliminary Outcomes.

This article reviews the literature and the authors' cases series of 13 nerve transfers operations in nine individuals with mid to lower level cervical SCI. The nerve transfers used donor nerves that were taken from nonessential uninjured muscle and transferred to improve elbow extension, wrist extension, and/or hand function. Individual patient outcomes are subtle and variable and can take months to 1 year to measure; however, they can dramatically improve function and independence. Results from the literature and the authors' patients (after a mean postsurgical follow-up of 12 months) showed gains in function based on manual muscle testing and patients' own reports. Further work is needed to determine the best timing and combination of nerve transfer operations, the combination of these with traditional treatments (tendon transfer and functional electrical stimulation), and measurement of outcomes.

Fox IK, Davidge KM, Novak CB, et al.
Plast Reconstr Surg. 2015 Oct;136(4):780-92.

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Functional electrical stimulation for the upper limb in tetraplegic spinal cord injury: a systematic review.
The aim of this study is to systematically review research on the effectiveness of functional electrical stimulation (FES) for improving functional tasks using the upper limb in people with tetraplegia. The authors systematically found 144 studies from September 2009 to September 2014. Only five studies met the inclusion criteria. All five reported improvements immediately and at follow-up in motor control and/or functional ability as a result of FES or FES combined with conventional therapy. There is some preliminary evidence that FES may reduce disability due to upper limb-related activity limitations in tetraplegia. Further work needs to examine the role of FES in more detail and in combination with other treatments.
Patil S, Raza WA, Jamil F, et al.
J Med Eng Technol. 2014 Oct;39(7):419-23.

Wheelchair ergonomic hand drive mechanism use improves wrist mechanics associated with carpal tunnelsyndrome.
Carpal tunnel syndrome (CTS) is a painful, debilitating condition common in individuals who use manual wheelchairs full-time. CTS is likely due to large forces on the wrist and the extreme range of wrist motion when pushing. The purpose of this project was to evaluate the use of an ergonomic hand drive mechanism (EHDM) that puts the wrist in a more neutral position. The EHDM uses a cam pawl and ratchet mechanism that grabs onto the tire during forward propulsion and releases it during the recovery phase. The EHDM was attached to the axle of both wheels on a manual wheelchair and could be rotated to the back of the wheelchair when not in use. Eleven manual wheelchair users with SCI completed trials with both a conventional manual wheelchair (CMW) and with the same CMW fitted with the EHDM. Average angular wrist orientations were compared between the two propulsion styles. Use of the EHDM resulted in reduced wrist extension and ulnar deviation. The results of this study indicate that EHDM propulsion reduces the occurrence of CTS risk factors compared with CMW use.
Zukowski LA, Roper JA, Shechtman O, et al.
J Rehabil Res Dev. 2014;51(10):1515-24.

Car Transfer and Wheelchair Loading Techniques in Independent Drivers with Paraplegia.
In people with complete paraplegia from SCI, car transfers and wheelchair (WC) loading are crucial for independent community participation but are physically demanding and can cause shoulder pain. Four females and 25 males with T2 to L3 paraplegia were videotaped while transferring and loading their personal WCs into and out of their own cars or vans. Drivers who transferred with their leading hand on the steering wheel had significantly higher levels of shoulder pain than those who placed their hand on the driver's seat or overhead. Those who loaded their WC frame into the back seat had significantly weaker right shoulder internal rotators. Understanding car transfers and WC loading in independent drivers is crucial to prevent shoulder pain and injury and preserve community participation.
Haubert LL, Mulroy SJ, Hatchett PE, et al.
Front Bioeng Biotechnol. 2015 Sep 17;3:139.

MOBILITY TRAINING

Does locomotor training improve pulmonary function in patients with spinal cord injury?
Fifty-two inpatients with SCI (both paraplegia and tetraplegia) were divided into two groups: group A received 4 weeks of both locomotor training (LT) and rehabilitation, and group B received 4 weeks of rehabilitation only. The LT program consisted of three 30-min sessions per week. Pulmonary function was evaluated spirometrically in both groups before and after the rehabilitation program. Forced vital capacity, forced expiratory volume in 1 second, forced expiratory flow rate and vital capacity (VC) and VC% increased significantly with LT in the first group. Maximum voluntary ventilation increased significantly in both groups. These findings suggest that LT is effective for improving pulmonary function in SCI patients. We also highlight the useful effects of LT, which are likely the result of erect posture, gait and neuroplastic changes that prevent potential complications in SCI patients.
Tiftik T, Gökkaya NK, Malas FÜ, et al.
Spinal Cord. 2015 Jun;53(6):467-70.

Mobility Outcomes Following Five Training Sessions with a Powered Exoskeleton.
This study was conducted to evaluate mobility outcomes for individuals with SCI after 5 gait-training sessions with a powered exoskeleton. Sixteen subjects with SCI were enrolled in a pilot clinical trial, with injury levels ranging from C5 complete to L1 incomplete. An investigational Indego exoskeleton research kit was used. Outcome measures included the 10-meter walk test and the 6-minute walk test, and measures of independence including donning and doffing times and the ability to walk on various surfaces. Results after only 5 sessions suggest that persons with tetraplegia and paraplegia learn to use the Indego exoskeleton quickly and can manage a variety of surfaces. Walking speeds and distances achieved also indicate that some individuals with paraplegia can quickly become limited community walkers using this system.
Hartigan C, Kandilakis C, Dalley S, et al.
Top Spinal Cord Inj Rehabil. 2015 Spring;21(2):93-9.

SEXUALITY

Sexual Function, Satisfaction, and Use of Aids for Sexual Activity in Middle-Aged Adults with Long-Term Physical Disability.
For this study, middle-aged adults with physical disabilities completed a survey that included measures of sexual activity, function, and satisfaction. Consistent with studies of able-bodied adults, sexual function was the strongest predictor of satisfaction. However, depression also decreased sexual satisfaction in women. Use of aids for sexual activity varied by disability type and was generally associated with better sexual function. Lowest levels of sexual satisfaction were reported by men with SCI.
Smith AE, Molton IR, McMullen K, Jensen MP.
Top Spinal Cord Inj Rehabil. 2015 Spring;21(3):227-32.

RESILIENCE AND COPING

Resilience predicts functional outcomes in people aging with disability: a longitudinal investigation.
The average age of persons with long-term physical disabilities is increasing. Individuals aging with a physical disability have a higher risk of symptoms such as chronic pain, fatigue, and depression. However, functional decline is not inevitable, and individuals often report high quality of life despite physical disabilities. One factor in determining quality of life in this population is "resilience," often defined as an ability to flourish in the face of negative life events. Resilience is based on several factors, including temperament (e.g., optimism), learned skills (e.g., mindfulness) and environmental supports (e.g., social connections). This longitudinal study was designed to investigate the links between resilience and depressive symptoms, social functioning, and physical functioning in people aging with disability and to investigate the effects of resilience on change in functional outcomes over time. Surveys were mailed to 1,594 individuals with: multiple sclerosis (509), muscular dystrophy (282), post poliomyelitis syndrome (389), or SCI (414). The survey response rate was 91% at baseline and 86% three years later. At baseline, resilience was negatively correlated with depression and positively correlated with social and physical functioning. Greater resilience at baseline predicted a decrease in depressive symptoms and an increase in social functioning three years later.
Silverman AM, Molton IR, Alschuler KN, et al.
Arch Phys Med Rehabil. 2015 Jul;96(7):1262-8.

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UNIVERSITY OF WASHINGTON
Rehabilitation Medicine, Box 356490
Seattle, Washington 98195–6490

ADDRESS SERVICE REQUESTED

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NWRSCIS Director: Charles Bombardier, PhD.

To add your name to the mailing list, contact the editor, Cynthia Salzman, University of Washington, Department of Rehabilitation Medicine, Box 356490, Seattle WA 98195-6490; 206-685-3999; *csalzman@uw.edu.*

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Mark Your Calendars for the 2016 SCI Wellness Summit—May 21

Learn about the wonderful world of assistive technology (AT) for making life easier and increasing independence for individuals with SCI at the 2016 SCI Wellness Summit on May 21, 2016, from 12:30–5:00 pm at the University of Washington.

Individuals with SCI, caregivers, family members and health care providers are all invited to attend this annual half-day educational symposium. The Summit program will include demonstrations, hands-on workshops, presentations and panel discussions covering the full range of AT possibilities, from inexpensive do-it-yourself devices to the latest in emerging technologies and resources. Continuing education credits will be available for therapists. Refreshments, networking and equipment displays are all part of this lively, informative event.

This is the fifth annual SCI Wellness Summit presented by the SCI Transitions Program and the Northwest Regional SCI System in the UW Department of Rehabilitation Medicine.

The Summit schedule, registration link and other details will be available in April. Check the website for updates:

http://sci.washinton.edu/Summit2016.

Read the newsletter online at *http://sci.washington.edu/info/newsletters*