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January 21, 2015.

United Spinal Webinar:

Getting a Handle: Technology for the Restoration of Arm & Hand
Function

>> Male Speaker: Thank you for joining us today for United Spinal
Association's webinar:

Getting a Handle: Technology for the Restoration of Arm & Hand
Function.

I will be your moderator for today's webinar. All of our webinars will
be archived on our website at spinalcord.org.

Please use the question window to the right bottom of your panel to
write in any questions you may have, and we'll do our best to get to
them today. For any questions remaining unanswered, please pose
those questions directly to the presenters and whose contact

information is displayed on the last slide.

Today's presentation -- today's presenters are Jennifer French, and Dr. Kimberly Anderson-Erisman. Dr. Anderson-Erisman is a research director the University of Miami school of medicine. Her research is focused on translational investigations and bridging the gap between basic science, clinical science, and the public community living with spinal cord injury. In addition to pursuing her own research regarding chronic injury, she serves as a scientific interface to the public for a diverse array of research being conducted at the Miami Project, and is now also managing their first cellular transplantation clinical trial.

Ms. Jennifer French was injured as a result of a snowboarding accident and had become quadriplegic from the C67 and complete level in 1998.

She is an active user of functional electrical stimulation, FES systems, and is executive director the NeuroTech Network.

Please note the instructions for use of closed captioning for this webinar appear in the chat window at the bottom. Now I would like to hand it off to Ms. French and Dr. Anderson Erisman's presentation.

Kim? Jen?

>> Jennifer French: Thank you for taking the time out of your day for

technology for the restoration of arm and hand function. So let's dig into some of the details and hopefully we can relay some valuable information to you.

As Bill mentioned in the introduction, there's a question area on screen. If you have a question, please pose it to us. We want to be able to answer the questions at the end, and if there's any unanswered questions, we want to be sure to address those as well.

During the webinar, we'll discuss a lot of different types of technology. We'll show you some websites as well. Those websites we have the link to them. Please be aware that the PDF version of this presentation is available on both the United Spinal website, Neurotech website, and the Miami project website. You can find the PDF and the direct links to this.

We'll also be discussing quite a bit of technology and how to access it. And from that standpoint we want to be sure to give you the links so you can access after the presentation.

So first let's introduce you to our two organizations. Kim, would you like to introduce the Miami project?

>> Dr. Kimberly Anderson-Erisman: Yes. The Miami project is based within the University of Miami in Florida. And our mission is to find

more effective treatments and ultimately cures for paralysis related to spinal cord and other injuries.

>> The Neurotech Network is a nonprofit and we focus on the education of accessing and access to neuro technology, devices therapies and treatments for people with various types impairments to their care givers and medical professionals. We provide a lot of resource, free resources, on our website. We make sure that our links are there and the education section of the Miami Project.

So our attorneys make us put up this in little disclaimer. We want to present information that will not replace the recommendations from a medical professional. You should consult in healthcare professionals familiar with your specific case, concerns and conditions. Neurotech Network and its representatives do not endorse, rate, sell, distribute, prescribe, admire or recommend he in products or service and we highly suggest you take the information we give you today and talk with a trained held professional.

Let's move on to the more informative areas of the presentation. We'll be going over the anatomy of the arm and hand, just to familiarize yourself, giving you a frame of reference when we talk about the technology, common clinical concerns and gives understanding of some of the terms, exercise, rehabilitation, therapeutics and

prosthetics.

We provide a brief overview of assistive devices for upper extremity and introducing you to some of the neurotech devices, in repetitive motion, sensing orthotics and stimulating therapies and neural prosthetics. We will provide resources where you can learn more about the general topic. Again, the PDF version will have the link of all of the websites we're providing here. If you're interested in one device we talk about, we can access the website and the manufacturers will have where you can find a trained medical professional in the area. And we can properly evaluate you. At this point, I would like to hand it over to Kim.

Kim, if you can dig into the anatomy of the arm and the hand.

>> Dr. Kimberly Anderson-Erisman: Okay. Thank you, Jen. We are going to talk just a little bit about the muscles and the arm and the hands. So you can get a little bit of reference to what we're discussing with different therapeutic applications. In trying to help improve function in different muscles in different areas. You can see on the screen the picture of the arm. The deltoid is for the shoulder. There's the biceps, and the brachialis. And sharing functions with the biceps. We have the triceps in the back of your arm. We have several extensor muscles to allow you to lift up your wrist, and extensors to help you flex down. And we're talking about spinal cord injury or other

neurologic damage where you have impairment of the muscles. There are different cervical segments that typically are responsible for the different areas.

So, for example, the deltoid is primarily enervated by the cervical 4-5 area. And then the biceps is primarily enervated by the cervical 5-6 area. The next one down is the extensors for the wrist. These enable you to lift up your wrist. And they're primarily in the C6-7 area. And we have the triceps which leads to the C7-8 enervation. And then the flexor muscles for the wrist are typically in the C8-T1 region. We go on to the hands and then on the next slide. As many people know, they have spinal injury or paralysis that often you may have an injury, say, for example, your level is a C5. And C5 is the last neurologically intact level. You have some bicep movement but below that in your wrist extensor, at C6, and triceps at C7-8 and further on, you may have paralysis in the muscles. You can have varying degree of paralysis and weakness. In the hand, it's a lot more complicated.

We use our hands to be very dextrous. And so I go over a little bit of the basics on the hands. If we look on the far left side here, we have muscles that are very important for our thumb movement and for our pinky movement. And being able to squeeze your hands together.

We also have intrinsic muscles to the hands, and they're called

lumbricals, and the interossei, between the different digits. And obviously, tendons going out into each of your fingers. There's a lot more to this but these are the main areas.

When you look at the neurologic innervation, these are three of the main nerves that come out of the cervical region of the cord, called the brachial plexus because it has several roots, radial nerve, median, and the ulnar nerve. They go down to different parts of the hand and responsible for sense says and movement. Those areas that you can see they correspond back to overlapping areas in the spinal cord and then depending on the lesion or the damage, it'll impact how depends on how much the paralysis are on your hands. We can talk about some of the cases for upper extremely weakness. This chart was designed in terms to stroke. This is pretty common to spinal cord injury, MS, and you may have weakness, you get atrophy. And you could get contractures and you get changes in shortening of the muscles which may be detrimental, and you may not be able to get full range of motion if you have a obstruction. Pain can be very common with upper extremely impairment. And particularly shoulder pain can be very common for stroke and spinal cord injury.

Muscle spasticity can be very common after stroke and after spinal cord injury. And it may actually interfere with function that you do have. You may have some residual voluntary movement in your arm

or hand, but if you end up have gone spasticity that strong and uncontrollable, 2 could prevent you from using that muscle. You can also have subluxation of the shoulder joint which is primarily caused by not using the muscles and it's pretty common in stroke, after stroke. And it can become common after higher cervical injuries. So now let's get into a little bit of our definitions and what we're talking about with rehabilitation versus exercise.

And the purpose of this particular seminar is to really focus more on neuro technology for rehabilitative types of interventions.

So rehabilitation, as it says here, is a treatment or treatments that are designed to actually facilitate the process of recovery from injury, illness, or disease to try to get you back to as near normal a condition as possible.

Now rehabilitation can focus on restoration or recovery. It can focus on compensation, that's where you use different muscles to perform a function. It can focus on your limitations and how do you adjust to that. And also on independence and how to use your rehabilitation to maximize your independence.

Now exercise on the other hand is physical activity that's planned, it's structured, and it's repetitive. The purpose is for conditioning any part of the body.

It's not purposefully for enhancing recovery.

Or keeping the body fit and conditioned.

Exercise focuses primarily on improving your health condition, maintaining or improving your fitness. And then preventing further complications from occurring or maintaining performance.

So another thing that we want to differentiate is using a device or using neuro technology in a therapeutic application versus a prosthetic application. If which therapeutic, it's designed to facilitate the process of recovery. And it's focusing on similar to rehabilitation, therapeutically you look at restoration or recovery of functions, enhancing voluntary control, and it's more community oriented. Whereas a prosthetic, or a prosthetic application, you're really looking at replacing a lost function or compensating for a lost function. You're not trying to enhance or restore function.

And then, again, the focus is on improving health conditions, enhancing compensatory measures and prevention and performance.

Now, it's not to say that our prosthetic application are replacing lost function will not have significant meaning. It can have a very big

meaning. But when we talk about what the devices are, used for, we'll talk about them in these types of applications. Okay.

So let's get into some of the first device. And the first one we talk to you about is this electric powered prehension orthosis, also called an EPPO. You can find these mechanically created as well, so they're not only electric. So basically, this is a device that goes on your hands. It utilizes your wrist extensor strength. So when you actually lift up your wrist, the device closes your fingers for you and giving you a three point pinch. A TENESTESI pinch or graph it is also called. There's an electric version, and mechanically based version of this as well. This website right here is where you can find this electronically powered version.

The other device here is the Gripability. It's entirely mechanical. You put it on your hands or wrist, there are different ways to apply it. And it is then you are just using it mechanically to do different functions. So in this particular picture, the person is using this to hold on to this device so they can make drawings on a piece of paper.

And another thing that is out on the market now is called the JACO robotic arm. If you go to this particular website here, can you actually

look at a video which shows you a equation of what it looks like and how it is used. This is a prosthetic device mounted to the wheelchair. It's usually for individuals that use a power wheelchair. And those who have very limited mobility in their upper extremities, the individual controls the arm with a joystick that is mounted to the chair. The arm has seven degrees of motion, giving it quite a bit of flexibility, and range. It has a three point pinch here you can see. The user can operate the arm to pick up things -- manipulate the arm to reach for things and pick up things and it can be very useful in your daily life if this is something you are looking for. This is a prosthetic application replacing arm function rather than trying to enhance recovery of your own arm function.

The next thing we'll talk about is upper extremity devices that can be used more in an exercise capacity.

And one of these is the RT300 arm bicycle. There's also the leg version of this that you can do, SES cycling. You can see the surface electrodes here, providing electrical stimulation to enhance muscles, and they're using the electrical stimulation to enhance the arm cycling movement. If you have weakness in the upper extremity, you can use the electrical stimulation to enhance the ability for arm cycling. If you have paralysis of the upper extremity then you use the upper extremity to do the cycling in that way. There was not much

research available recently, however there's quite a bit research showing that electrical stimulation in general is very useful for upper extremity exercise. For enhancing weakness and for just initiating movement, when you have total paralysis.

Another device is out there. It's from MotoMed. You can find that here. And it is, can look somewhat similar to the SES cycle. There's a leg portion and an arm portion. You can use this in a passive mode where the machine does the work for you. In a motor assisted mode where you are doing most of the work, but a machine is helping you a little bit. Or you can use it for arctic resistance mode -- active resistance which would give you the greatest exercise and workout ability.

Again, there's not a lot of recent research available regarding this particular device, but doing upper extremity exercise in this manner, cycling, has been studied quite a bit extensively with other devices, for example, with arm cycling.

The last thing I will talk about before I hand over to Jen again, is with the vibrations.

And there's a device out there called the Galileo. UpX Dumbbell. You can look at that here, the estimate designs model. And this is use -- the Stim Designs company. And you can use it to enhance arm strength or promote relaxation of muscles that may have a-- contraction. The in this example, the person has hand Gripability. They can hold on to it while they do the exercises, and the machine is vibrating while do you the exercises. If you is it not have the hand grip, you could use an adaptive glove to strap your hands to it and use it that way. Obviously, you can do these sitting down in a wheelchair as well.

There is quite a bit of evidence that shows that the whole body vibration in general during exercise can improve upper body strength. I think there is more research that is needed regarding the effectiveness of vibration therapy for enhancing or as a rehabilitative component of improving upper extremity strength when it comes to the different neurologic impairments. For example, spinal cord injury, we need to know more about what type of vibration and frequency of exercises should be used. And that would be a little bit different for multiple sclerosis and may be different for stroke. In that area, we need more research. But certainly, whole body vibration has shown to be a good adjunct to upper extremity exercise. I will let Jen take over the next part of the talk.

>> Jennifer French: Great. Thank you, Kim. I we'll dig into some of

the neuro technologies. The first category is called repetitive motion therapy. These types of devices you can see we have two examples here. One is the Armeo for Hocoma. And this is their website here. And the WAM Arm from barrette technology is also shown here. This is their website. These types of technologies you typically find in the clinic. They're used for repetitive motion therapy. And research has shown that users have a greater benefit if they have some minimal function before using this.

So typically, you might see this also called robotic rehabilitation training. Again, it's for repetitive motion, just to augment or to supplement the therapy in terms of recovery of the upper extremity. There's a lot of research in terms of stroke and also in spinal cord injury and in TBI for recovery of upper extremity.

There's also another category in terms of the repetitive motion therapy. These are two other devices which also use the basic repetitive motion therapy. One is an Ames therapy device. This is their website here. And the InMotion interactive which is also available for interactive motion therapies. So typically, what we find is that the motion therapy, these two devices also improve sensorimotor impairment, proprioception, where your arm is in space in basic terms.

These types of devices have guidelines actually written from both the American Heart Association and the VA -- DOD in terms of recommendation for rehabilitation for stroke, very specifically. Now these four devices repetitive motion we reviewed here, they're typically not for home use. You find them in a clinic. It's so important to go to each one of the websites to find out where you can find the clinic, where the device is, and working with a medical professional trained with the device to be able to meet your therapeutic goals.

The other category is a sensing orthotic. Kim went over the sensing devices, orthotics, and mechanical but these have a different spin to them, if you will.

They have some sensing motion to be able to assist in the movement. For instance, this is the MyoPro from Myomo. And this is their website here. And a custom orthotic used in upper extremity. Sensors so you can sense where you want to move your arm and do the full function. The gentleman displaying this here would normally not be able to bend his arm this far of a motion but the device is assisting him to be able to do that to hold his dog. This is a very custom made device. Saeboglove is also a sensing orthotic. It's used more for gross hand movement. A glove you with where sensors to open and close the hand. This is the website used to be able to access the device.

Both devices are custom made and both are available for home use.

For an upper extremity for both of these device.

Other neuro technology we'll talk about is used for a therapeutic or rehabilitative goal. These are sensing and stimulating therapy.

So what these devices are -- I will introduce them to you.

The devices are the Biomove Home, available at the Biomove website.

The MyndMove from MyndTec, available on their website as well.

Available for clinical use, and the Neuromove from Zynex medical, they have a sensing feature. They use EMG sensors to sense a little bit of movement and they have stimulating electrodes. As the therapy takes place, if someone was trying to say open their hand, they may not be able to open fully or have a very weak movement, the EMG sensors sense the movement and the stimulating kicks in to complete the full movement. That's why it's huge from a therapeutic perspective. -- viewed from therapeutic. And sensing combined with electrical stimulation. And the studies have shown that the users have been able to maintain movement post treatment. They have a periodic treatment or do you it on however it's prescribed. Say it's prescribed three, our four oh, five days a week let's say, in terms of treatment, and once they no longer use the treatment, they find some

recovered gross movement in the upper extremity. Again, the devices are mainly available for home use. Mind tech is available in Canada, and working on becoming available in the United States.

And there's something called a neuro prosthetic. Here we feature the Ness H200 from Bioness. We call it a prosthetic because it's main function designed for doing very specific tasks. How does it work? Here you see in this picture this is almost like a brace you put over the forearm that it shows here. Embedded in the brace in stimulating electrodes to stimulate the hand to do gross functions. For instance, this user here is showing a pinch to be able to pinch that shoe lace and to be able to hold it.

The studies have shown there's potential benefit in increased range of motion, hand function, re-education of muscle, and we'll go over that in just a second. And increase in circulation and reduced muscle spasticity.

We said this is from a prosthetic standpoint from terms of functional hand grasp. That's what it is approved for. In some ancillary studies, they have been able to find that people have gotten a therapeutic use from the days device reeducating the muscle again. Typically, in some with preserved function prior to use. It play be weak but able to strengthen it and doing re-education or neuro plasticity, if you will. That's the neuro prosthetic device.

Finally, a couple of stimulating experimental devices we want to introduce you to. We have done webinars in the past talking about clinical trials and we strongly advocate for looking for trials on [clinicaltrials.gov](https://www.clinicaltrials.gov). This is a website where you are able to find different types of clinical trials for different types of purposes.

We're not going to go over all of them, but we want to highlight a few of them there that have active studies going on and be able to introduce you to those. We encourage you to go to the [clinicaltrials.gov](https://www.clinicaltrials.gov) website and look up, if you are interested in the devices or others for upper extremity. And you can find the contact information or the criteria, or look into the archives of the webinar that we hosted here with United Spinal and look at the clinical trial information as well.

So here, the three devices. The first one is STIMuGRIP by Fine Tech. And they are researched in the UK. It's a prosthetic device to be used to provide different types of grasps in the hand. This device is also very similar to the implanted device that's being studied at the Cleveland FES center for the upper extremity, spinal cord injury. Implanted device, implanted electrodes to restore a grasp. We may have some people in the audience who are what we call Freehand users. Back in the early '90s, there was a device that implanted device that was available on the market. It was called Freehand. It was

no longer available on the market, however, the researchers were able to gain some access to the technology and they have set up a user group. Anyone who has the device, that's up [audio cut out a second] anyone with the device is able to access the group and able to get in touch with the researchers who designed the device. Many prosthetics used for different types of hand grip are being studied for spinal cord injury. The last experimental device is this one here called Contralateral stimulation or FES for stroke. This device is being studied for hemiplegia, for stroke, upper extremity. The way it's designed. A gloving put on the user that has the functioning hand and stimulating electrodes put on the paralyzed hand. Once the user wants to open the hand that's functioning, the one with the glove on, it has sensors in it. And those sensors will connect to the stimulating electrodes that create the same motion, for instance, to open the hand.

This picture is showing them closing the hand for a cup. For instance, the user would want to close the hand with the gloving on it. And the signal goes to the stimulating electrodes which stimulates the paralyzed hand to be able to close in the function as well. This can be found at the Cleveland FES Center or all of them can be found at clinicaltrials.gov. We talked a lot about technology in the presentation today. We want to leave you with additional resources. The PDF version of this presentation is available on the United Spinal website, the neuro tech, and the Miami Project website. So all the links are

available to you, but we want to provide you with additional resources as well. On the Miami Project website, with this link that is here, you can download this booklet that's specifically for experimental treatments for spinal cord injury and what you should know. And just recently we have been adding in technology to this resource. You can also go to the website and follow paralysis support, research participation and experimental treatment to learn more about that.

International spinal cord society, on their website they have a resource. In terms of upper extremity technology. Again, there's a table in there that specifically goes over some of the technologies that we talked about today, and some additional therapies using different types of technology to restore function or augment rehabilitation.

And finally, the NeuroTech Network website. We provide several free what we call fact sheets or resources and each fact sheet is dedicated to a different condition. Spinal cord injury, stroke, MS, cerebral palsy, brain injury, and all are available at this link. You can find several links to the manufacturers of the device.

If you are interested in one of the devices, go to the website links or contact the manufacturer and find a clinician in your area to properly evaluate you to the technology and see if you would be a benefit. -- to see if you would be a benefit of the technology. That concludes the presentation. We want to open up to questions and provide you with the contact information. Kim's e-mail address as well as my e-mail

address is available on the screen. If you have any more specific questions, we would be happy to answer them. Thank you for attending, and we want to hand it back over to Bill to address any questions that might be there.

>> Bill: Thank you, Jennifer, and Kim for your presentation today. We have a couple questions.

Can you recommend a good hand grip gloving.

>> Jennifer French: We did earlier in the presentation -- we did display the Saebo glove. That gives gross movement, if you will, in the hand. You might be looking towards. That's a more complex device. We went over some of the assistive devices that are more mechanical in nature. But the Saebo glove, otherwise known as the bionic gloves might be one that would interest you. I would encourage you to go back in and look at that slide and access their website to learn more about that glove.

>> Bill: Again, as a reminder to the audience. This entire presentation will be archived at www.spinalcord.org within approximately one week. So you can re-examine, replay, the entire presentation and not lose access to the valuable information that Jennifer French and Doctor Anderson Erisman presented today. Another question for you Jen, and Kim, whoever would like to tackle this. This goes to the subject of FES therapy.

Does FES therapy help promote function, and I guess we're speak of voluntary motor function, or is it the biggest result more of an exercise

benefit for the muscles involved?

>> Dr. Kimberly Anderson-Erisman: I think there's two answers to that question. And it kind of depends on what the status of your muscle is. So if you have a little bit of voluntary movement, for example if we talk about the hands. If you have a little bit of voluntary movement in your thumb, you can use electrical stimulation in combination with repetitive motor taps to actually improve function in your hand, voluntary function in your hand.

But the key there is that you had to have a little bit of residual Volvo control. If you are looking at a muscle that has here -- residual voluntary control. If you are looking at a muscle can zero Volvo control, the FES can be useful in a purely exercise type of capacity. The electrical stimulation is exercising the muscle in the contraction and the relaxation, which can be very beneficial. But it's not necessarily influencing the neurologic status of that muscle

>> Jennifer French: If I can add to Kim's answer. Also in terms of functional electrical stimulation, there's an application as a prosthetic. That's the term we introduced earlier in the presentation. In terms of using that stimulation for a very specific function, for instance, a grasp or a pinch. And there was a device, the H200 that we showed where it can provide some of that. The key thing to be able to use an FES as a prosthetic device is that it goes off of the peripheral nerves to be able to stimulate the muscle. It's very important that the peripheral nerves

are intact to get stimulation for gross movement, for a prosthetic application.

>> Bill: Thank you, Kim, and Jen, that's a great explanation. I knew it would be a multi-tiered explanation. A question from someone from outside of the country actually from India. Their question is, from India, their interested to know whether some of these devices can be made available in the country of India?

Would it be likely that they would be able to access this emergency is should they contact you or the manufacturer directly -- access this technology, and should they contact I. What is your thoughts on the access out of country.

>> Sure quite a few device being used and researched outside of the United States and even North America. Specifically, what is available in India I wouldn't know off the top of my head, but I would recommend to be able to go to the specific manufacturers and see if they have their devices available in India specifically, or for those in any other country here on the website, or here on the webinar, to see if there may be countries where they're available in. There's a lot of research going on in Australia, China, as well as Japan, and in the Middle East, and Israel. So there's quite a bit of research going on in the world, and devices available around the world.

Go to the specific manufacturers. And the resources we provided earlier cover different types of therapies that are available

internationally, so The International Spinal Cord Society has international access. I hope that answers your question?

>> Bill: I think that it probably does. Thank you for that.

Again, we're getting multiple questions on the availability of this presentation. Give us about a week. This entire presentation can then be archived at www.spinalcord--spinalcord.org. And those are the questions we have for you today, Kim, and Jen. On behalf of United Spinal association I would like to thank you -- Jennifer French, Executive Director of NeuroTech Network, and Dr. Anderson-Erisman from Miami Project -- so much for sharing your experience on Getting a Handle, Technology for the Restoration of Hand and Arm Function.

Our next webinar is February 4, 3 to 4:00 p.m. on Examination of biosimilars.

And the next presentation, February 9. 3 to 4:00 p.m, just in time for Valentine's Day. Case embracing sexuality after SCI, and tips from a sex therapist.

That ends today's presentation. Thank you for your presentation to our audience, Kim, and Jen, and we will see some of you back here for our next webinar presentation. Thank you.

>> Jennifer French: Thank you.

>> Dr. Kimberly Anderson-Erisman: Thank you.

[Webinar complete]