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A PATIENTS GUIDE TO: **SPINAL CORD STIMULATION**

What is Spinal Cord Stimulation?

If you or someone you care about has been living with chronic pain, spinal cord stimulation (SCS) may provide new hope. Spinal cord stimulation is a medical therapy for people who suffer from certain types of chronic neuropathic pain. SCS is not a cure for pain. The objective with this therapy is to reduce a patient's pain to a manageable level, so the patient can return to a more normal lifestyle.

Spinal cord stimulation is actually part of a broader category of therapies called neurostimulation, which includes peripheral nerve stimulation. Neurostimulation therapies are used for pain relief or symptom relief from certain types of chronic pain and neurological disorders.

Spinal cord stimulation and peripheral nerve stimulation use an implanted device—a spinal cord stimulator (sometimes called a pacemaker for pain)—to deliver low levels of electrical energy directly to nerve fibers. This direct approach to treating pain at its source can be very effective.

The type of neurostimulation that might be appropriate for your condition depends upon many factors, including the cause of your pain or neurologic disorder as well as its type and location.

A Treatment with Real Advantages

Spinal cord stimulation has three significant advantages. First, it can be very effective in reducing chronic pain from certain conditions. Second, you will have an SCS trial before you have a permanent system implanted. An SCS trial allows you to see if the therapy will work for you. And lastly, the implanted device can be turned off permanently or removed if you don't achieve the desired level of relief.

How Does Spinal Cord Stimulation Work?

To understand how spinal cord stimulation (SCS) works, it is helpful to understand the components of a spinal cord stimulation system. SCS systems typically consist of three components designed to work together:

- Leads
- A generator/receiver
- A programmer/transmitter

Getting a SCS system involves a relatively short surgical procedure during which a lead or leads are placed in the space above of the spinal column (epidural space) and a generator/receiver is inserted under the skin. The leads are connected to the generator/receiver. When the generator/receiver's power is turned on, electrical energy is sent through the leads to electrodes that stimulate the nerve fibers associated with painful areas.

This stimulation effectively changes the pain messages and replaces them with a more pleasant sensation called paresthesia. If a patient likes the stimulation sensation, and it helps to relieve his or her pain, then spinal cord stimulation is a good option. For some patients, however, the sensation is not pleasant and/or it does not relieve pain. That is why a trial procedure is normally performed to determine how a patient will respond to stimulation.

Each type of SCS system has advantages and disadvantages. Should you consider getting a spinal cord stimulator, you and your physician will decide which system is best for your situation. This decision will be based on factors such as your pain pattern, your lifestyle, and how much electrical energy is required to provide adequate pain relief.

Leads

Leads are very thin wires or cables. One end of the lead is connected to the implanted generator/receiver, and the other end is placed near the nerve fibers that are to be stimulated. The end near the nerve fibers has metal electrodes that can deliver mild electrical impulses. Manufacturers offer a variety of leads to meet the needs of patients and physicians. Leads can vary by

- Type (such as whether they are percutaneous or surgical)
- Number of electrodes (such as 4, 8, or 16)
- Electrode shape, configuration, and spacing
- Length

Types of Leads

Percutaneous leads can be implanted through a needle and may not need a surgical incision. The advantages of percutaneous leads are that they are faster and easier to place. The disadvantages are that they are more prone to move (migrate) than surgical leads and that their cylindrical electrode shape makes them less energy efficient.

Surgical leads, also called paddle leads, are larger and require a surgical incision. The advantages of surgical leads are that they are less prone to move (migrate) than percutaneous leads and that their flat shape makes them more energy efficient. The disadvantage is that they do require a surgical procedure to place (implant).

Percutaneous leads are almost always used for trial stimulation, whereas either percutaneous or surgical leads can be used for permanent implantation.

Number of Electrodes

Each lead has at least four electrodes, but a lead can contain as many as 16 electrodes. The number of electrodes used depends upon the condition being treated as well as the

physician's preference. For example, more complex pain patterns, such as those involving more than one area and more than one extremity (arms and/or legs), involve more nerve structures. Additional electrodes are often required to stimulate all of these structures.

Implanting fewer electrodes than you need can result in less pain relief. In fact, many physicians believe that it is best to implant extra electrodes, just in case the pain pattern changes or the lead moves (migrates). If a change or migration occurs and extra electrodes are available, your physician can often reestablish pain relief by “electronically repositioning” the electrodes. Electronic repositioning is accomplished by reprogramming the power supply, which requires a visit to your physician.

However, if the lead migrates and extra electrodes are not available, then you may have to undergo another surgical procedure to reposition the lead. Thus, placing extra electrodes is like buying insurance, because it provides you and your physician with some protection against possible problems.

Power Source—IPG, rechargeable IPG and RF Systems

Three types of SCS systems are available for spinal cord stimulation: conventional implantable pulse generators, rechargeable implantable pulse generators, and radio frequency systems. Each of these systems uses a different power source to send the electrical energy to the electrodes:

- **Conventional implantable pulse generator (IPG).** An IPG is powered by a battery. The IPG itself consists of the battery and electronics that are housed in a single metal container, which is completely implanted under the skin. The IPG is connected to a lead or leads that are placed over the spinal cord. It is important to note that from time to time the IPG must be surgically replaced when its battery runs out.
- **Rechargeable implantable pulse generator (rechargeable IPG).** Like a conventional IPG, a rechargeable IPG is battery powered and consists of a battery and electronics within a metal container that is implanted under the skin. The difference is that the rechargeable IPG's battery is rechargeable. How often the battery must be recharged depends on how much the rechargeable IPG will eventually reach a point when its battery fails to hold a practical charge. This means that the charge will not last long enough for routine activities, such as working a normal job shift or attending a sporting event. When this happens, it is necessary to replace the rechargeable IPG in a surgical procedure.
- **Radio frequency system (RF).** With an RF spinal cord stimulator, the power source has two parts: a receiver, which is implanted under the skin, and a transmitter, which is worn outside the body like a cell phone or pager. The receiver contains a metal antenna and electronics—but no battery—and is connected to the leads. The transmitter, which contains an antenna, electronics,

and a replaceable or rechargeable battery, delivers radio waves through the skin to the implanted receiver. The receiver then sends the electrical impulses to the lead(s).

Programmer/Transmitter

A programmer and transmitter are devices used to program an SCS system and to adjust the intensity of the stimulation. Programs are the various electrical settings (amplitude, frequency, pulse width, and polarity) that are transmitted to each electrode on the lead.

The external programmer/transmitter allows your physician to create as many programs as he or she feels is necessary (up to 24) for your pain patterns. It also allows you to choose the best program for your pain as it changes throughout the day or as you move or change positions. A programmer/transmitter allows you to change programs and turn the stimulation up or down—just like you can change the channels or volume on your TV with a remote control. In fact, some people call the spinal cord stimulation system “a remote control for pain.”