

Spinal Cord Stimulation

Dr Simon Thomson explains.

Spinal cord stimulation is part of a family of treatments known as neuromodulation. Neuromodulation is any reversible treatment that interacts with the activity of the nervous system whether by electrical stimulation or by medicines acting centrally on the brain.

Spinal cord stimulation uses electrical pulses to generate an electrical field within the spinal cord. It is most successful at treating conditions affecting the parts of the nervous system that relay sensory information from the body (the somato-sensory system) and/or the autonomic system, which controls functions such as heart rate. Work with animals measuring changes in spinal cord chemistry has helped explain how spinal cord stimulation works.

Pleasant Sensations

To achieve pain relief using spinal cord stimulation it is crucial that the patient feels pleasant sensations in the area of their pain. The goal of both the surgeon and manufacturer is to achieve as near as possible to 100% coverage and to maintain this long term.

This has been achieved by multiple electrode systems with ever more programming ability so that different programmes can be run simultaneously in order to achieve the best pain relief.

In order to provide the necessary power for sufficient time, rechargeable systems have had to be developed to save battery costs.

Pain Conditions that can Benefit

The main pain conditions that spinal cord stimulation is used for are nerve pain (neuropathic pain) affecting the back and legs pain following spinal disease and surgery; complex regional pain syndromes; painful polyneuropathy, as well pain due to lack of blood flow. Other pain conditions that can benefit from spinal cord stimulation are being identified.

Because it is a surgical treatment, most doctors have regarded spinal cord stimulation as a treatment that is only used after other less invasive options have been tried. However, some recent trials assessing both the pain relief achieved and cost have suggested that spinal cord stimulation could be considered earlier.

Safe Therapy

Spinal cord stimulation is a safe therapy with only rare reports of harm. However, the treatment should only be carried out in centres with all the necessary experience. This includes patient and device selection, implantation, troubleshooting and audit.

As our understanding of chronic pain and the available therapies have evolved it has become more important to develop pathways of referral and treatment networks so that all patients who need spinal cord stimulation can have access to it.

THE OPERATION

The spinal cord stimulation electrodes are placed in the epidural space that surrounds and protects the spinal cord. How this is done depends on the electrodes. Plate electrodes require a window to be cut in the spinal bone (laminotomy) to allow placement. Cylindrical electrodes can be placed through the skin (percutaneously) though a needle, like an injection. In either case an electrical field is generated that targets the exact spot within the spinal cord that processes the nerve messages from the part of the body that is painful. This is not easy because of the distance between the spinal cord and the electrode and the low electrical conductivity of the tissues.

As you go up the spinal cord nerves join it from the different regions of the body. If the electrodes are placed too low down then they will miss the messages that they are trying to stop. Knowledge of what nerves enter at which point helps the doctor to put the electrodes in the best place for each patient.

Sweet Spot

Some doctors using this technique believe that each patient has a “sweet spot” such that a single electrode placed in exactly the right place will evoke the necessary sensations wherever the patient needs. However, most now believe that many electrodes placed close together over 2 spinal levels with multiple programmes working together offers the best chance of 100% coverage.

The whole system is surgically implanted. The electrodes lie in the epidural space around the spinal cord. The electrical pulse generator is put beneath the skin like a cardiac pacemaker either in the abdominal wall or the “back pocket position” in the buttock.

THE EQUIPMENT

Various companies produce spinal cord stimulation systems and there is a range of products available. The pulse generator can be powered by one of three ways. It can have an external power source that induces current in an implanted receiver. Secondly it can have its own long lasting battery. Or finally it can use a rechargeable battery.



The weakest part of the system are the electrodes and electrical junctions. They can often move from their position, which reduces their effectiveness. One advantage of using many electrodes is that small degrees of electrode movement can be corrected by reprogramming the pulse generator.

Movements of the body may repetitively bend and break the leads. Studying the most common sites for such damage has led to improved technology that protects the lead through the tissues and allows free movement of the internal electrical fibres. This has improved the working life of the leads.

HOW SPINAL CORD STIMULATION IS CARRIED OUT

Spinal cord stimulation is not a stand-alone treatment. Many patients being considered for this therapy have suffered chronic pain a long time and have tried a variety of different treatments. As such they have complex needs of which pain relief is only one. The British Pain Society recommends that only a team that is experienced with spinal cord stimulation provides this treatment and that a multidisciplinary support team helps the patients going through the procedure.

It Makes Sense to Offer a Trial

Once spinal cord stimulation has been selected as a possibly useful therapy it is common that the patient will be offered a trial first. This is because not everyone with what would appear to be the right sort of pain will respond to the treatment and some will simply not like the sensation. In others it may not be possible to map out enough of the painful areas to have a useful effect. So with these patients, a trial prevents an unnecessary implant. There is some evidence that in some patients who report only marginal pain relief at the start of therapy there may be worthwhile pain reduction in the long term. There is still some debate about the benefit of a trial but to me it makes sense to offer it. However, a trial should never be a substitute for a full and detailed assessment of the patient's suitability for spinal cord stimulation.

Two Approaches

As mentioned above, there are two approaches to epidural lead placement. The surgical approach uses a small plate lead with anything between 4 and 16 electrode contacts. The percutaneous (through the skin) approach uses cylindrical leads threaded down an epidural needle with up to two leads each with 4 or 8 electrode contacts. The commonest technique worldwide is the percutaneous one, although in the UK it has been about half and half with most doctors now favouring the percutaneous approach.

Percutaneous Approach

Before undergoing the procedure, the patient has been well counselled about the procedure by one of the team. The site of the needle insertion is made numb with local anaesthetic. The procedure is almost painless. The cylindrical electrodes are sited at the correct level in the epidural space through an epidural needle. The operator uses a moving X-ray camera to position the electrodes at what he or she judges from experience to be the right level. The lead is then connected to a temporary stimulator and the resulting sensations are mapped over the pain sites. Once this is completed the lead is carefully anchored to the underlying back muscles and soft tissues. A temporary extension of the lead to outside the body is connected so that the spinal cord stimulation can be trialled. The skin wound is closed over and carefully dressed. We usually continue the trial for a week, sometimes two. Because the lead is run through the skin to the outside there is a slight risk of wound infection. Your healthcare team will obviously be aware of this possibility and will monitor the wound.

Patients Make Changes to Their Stimulation as Required

If the trial simulation does provide good pain relief then the full implant can be carried out a week or so later. This is usually done under general anaesthesia but can be done under local anaesthesia. It's just that the procedure may involve 2 or 3 incision sites, which some patients don't like under local anaesthesia alone.

The implantable pulse generator is programmed wirelessly using a computer. The programming can be changed from time to time depending upon the patient's progress. Each patient has their own handheld programmer with which they can make changes to their stimulation as required.

WHEN SPINAL CORD STIMULATION SHOULD BE USED

Although spinal cord stimulation may to some sound like the stuff of science fiction it is not. I am convinced that in the right patient, with the right pain delivered, by the right team it can make massive improvements in quality of life for some chronic pain sufferers and as such should be available to all those where it has been shown that they are likely to benefit.

Trials Demonstrate Improvement in Pain and Quality of Life

There are barriers to access to this therapy. We already know that there is widespread ignorance of the extent and severity of chronic pain syndromes within the population. Secondly there continues to be some scepticism that this therapy offers both clinical and cost effectiveness in the management of certain chronic pain syndromes. Thirdly there has been insufficient investment in centres of neuromodulation and fourthly, referral networks have not been adequately established. Some of these battles are being fought and won. For example two recent high quality research trials have been published that demonstrate the improvement in pain and quality of life when this therapy is added to the range of options for patients. The Neuromodulation Society of UK and Ireland (www.neuromodulation.com) and the British Pain Society (www.britishpainsociety.org) are working with NICE (the National Institute for Clinical Excellence), the NHS and the Royal College to raise awareness as to the need of providing resource for the provision of spinal cord stimulation within the UK.

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Edith Mowatt is willing to talk about her own experience with Spinal Cord Stimulation to anyone who is considering having this therapy. You can contact Edith through Pain Concern.