

Non-Invasive Treatment of Spinal Pain

Ryoong Huh, MD, In Bo Han, MD

Department of Neurosurgery, Pochon CHA University, Bundang CHA
Hospital,
Sungnam, Korea

Corresponding author: Ryoong Huh, M.D.

Department of Neurosurgery, **Bundang** CHA Hospital,
Pochon CHA University, 351, Yatap-dong, Bundang-gu, Sungnam, 463-712, Korea

Tel: (031) 780-5260 • Fax: (031) 780-5269 • E-mail: hrnsd@hanmail.net

Abstract

Spinal pain affects a significant proportion of the population. The treatment goals are to relieve pain, reduce muscle spasm, improve strength and the range of motion, promote early return to activity, and ultimately improve functional status. The actual treatment for spinal pain comprises a number of different interventions such as drug therapy, physiotherapy, surgery, and alternative therapies. However, despite its various kinds of treatments, the efficacy remains controversial. SCENAR standing for Self-Controlled Energy Neuro-Adaptive Regulator is a noninvasive therapeutic modality that was introduced more than 20 years ago, and mainly used for pain relief by electrical impulses via skin surface electrodes. This review summarizes the noninvasive treatments for spinal pain including SGENAR therapy.

Introduction

Spinal pain is the most frequently occurring disorder treated at our pain clinic. It seems to occur in virtually everyone's lives at some point but becomes chronic and intractable in only about 10% of all cases. It will apply to all regions of the spine, cervical, thoracic, lumbar, sacral spine. Spinal pain has a significant impact on functional status, restricting occupational activities with marked socioeconomic repercussions.

The management of spinal pain encompasses a range of different interventions, including drug therapy, surgery, exercise, patient education, physiotherapy, and alternative therapies. The treatment goals are to relieve pain, reduce muscle spasm, improve strength and range of motion, promote early return to activity, encourage active coping strategies, and ultimately improve functional status. The risks and benefits of these treatments vary. The management of acute or chronic spinal pain warrants separate consideration as these conditions may respond differently to the same interventions.

SCENAR was first invented in Russia in mid 80s under space and military research program. SCENAR device generates electrical impulses that are physiologically similar to neuroimpulses. The clinical benefit provided by SCENAR therapy remains controversial, however, this study suggests that SCENAR therapy would be very useful method to deal with spinal pain.

Common "physical" causes of spinal pain

Simple Sprain: Usually a superficial area of the spine such as a joint, ligament or muscle is hyper-extended or twisted causing inflammation.

Severe Sprain: More extensive and prolonged often resulting in sensitization of the spinal cord (dorsal horn) thus even minor amounts of stimulation are magnified by in the spine creating muscle spasms and a cycle of persistent pain.

Postural Pain: Imbalances in body position can result in painful muscles, ligaments, tendons and joints that receive increased pressure/strain as a result. It has been reported that the sum of the inward curves of the spine (cervical and lumbar lordosis) should equal the sum of the outward curves of the spine (thoracic and pelvic kyphosis). If they are not equal, then posture may be out of alignment with resulting pain. Certainly, posture with regard to sitting, standing, bending, lifting, etc. all become significant for the development of persistent pain problems.

Mechanical Imbalance: Some minor differences exist between our left and right leg lengths normally. When these differences are large they can result in our pelvis tilting toward the shorter leg. Compensation occurs in our spinal structures (usually altered spinal curves) from lumbar through cervical regions setting up painful muscle and other pain.

Spinal Ligament Pain: Sometimes occurs as a result of disc degeneration or spondylolisthesis. In the former, loss of disc height results in increased tension on the lumbar-pelvic ligament. In the latter, there is tension on the iliolumbar ligament at the base of the spine. Both can produce back pain.

Facet Joint Pain: In the small spinal joints on the sides of the vertebrae inflammation or articulation problems can occur resulting in back pain.

Spinal Nerve Root Pain: Irritation or compression of a spinal nerve root sometimes resulting in pain, tingling, numbness, and/or weakness. Most commonly, when inside the spine the disorders are: disc herniation, annular tear in wall of the disc, spinal stenosis, epidural

adhesions occasionally because of infections after surgery, or spinal tumors which are rare. Back pain sometimes results from dysfunctions outside the spine. They can include: thoracic outlet syndrome with cervical nerve compression by a rib or scalene muscle spasm in the neck, piriformis syndrome, which is sciatic nerve compression because the piriformis muscle in buttock is in spasm, and rarely tumors outside the spine.

Failed Back Surgery Pain: The surgical process of correcting spinal disorders can itself create residual pain. This can come from several sources including scar tissue formation, infection, blood vessel and nerve damage.

Osteoporosis: Bone thinning can result in vertebral fractures resulting in episodes of back pain. It is most often in the elderly and frequently in the mid and upper spine regions.

Noninvasive therapeutic Modality

Intramuscular stimulation (IMS): IMS uses some of the tools of acupuncture, but it differs fundamentally in that it is based on scientific, neurophysiological principles. IMS is applied directly to the site of the pain, rather than to remote points based on maps of energy flow. IMS directly treats the cause of the pain by relaxing the shortened muscle and allowing it to return to its normal state. A trained therapist inserts very fine needles (like those used in acupuncture) into the shortened muscle at the points where it is tight. The needles change the electrical potential of the muscle, and cause micro-injuries that stimulate blood circulation and healing. The needles cause almost no pain when inserted into normal muscle. They cause painful cramping when they are inserted into a shortened muscle; but after the muscle cramps, it relaxes. What has happened is that the needling has caused your abnormal muscle shortening to intensify and then release. However, the efficacy and clinical benefit of IMS remains controversial.

Prolotherapy: The basic mechanism of Prolotherapy is simple. A substance is injected into the affected ligaments or tendons, which leads to local inflammation. The localized inflammation triggers a wound healing cascade, resulting in the deposition of new collagen, the material that ligaments and tendons are made of. New collagen shrinks as it matures. Prolotherapy involves the treatment of two specific kinds of tissue: tendons and ligaments. A tendon attaches a muscle to the bone and involves movement of the joint. A ligament connects two bones and is involved in the stability of the joint. A strain is defined as a stretched or injured tendon; a sprain, a stretched or injured ligament. Once these structures are injured, the immune system is stimulated to repair the injured area. Because ligaments and tendons generally have a poor blood supply, incomplete healing is common after injury. This incomplete healing results in these normally taut, strong bands of fibrous or connective tissue becoming relaxed and weak. The relaxed and inefficient ligament or tendon then becomes the source of chronic pain and weakness. The greatest stresses to the ligaments and tendons are where they attach to the bone, the fibro-osseous junction. The most sensitive structures that produce pain are the periosteum (covering of the bone) and the ligaments. It is important to note that in the scale of pain sensitivity (which part of the body hurts more when injured), the periosteum ranks first, followed by ligaments, tendons, fascia (the connective tissue that surrounds muscle), and finally muscle. Cartilage contains no sensory nerve endings.

Transcutaneous electrical nerve stimulation (TENS): It is a noninvasive therapeutic modality that was introduced more than 30 years ago. TENS units stimulate peripheral nerves via skin surface electrodes at well-tolerated intensities and are capable of being self-administered. The development and application of TENS were based on the gate control theory. According to this theory, the stimulation of large afferent fibers (A-beta) activates inhibitory interneurons in the substantia gelatinosa of the spinal cord dorsal horn and, thereby, attenuates the transmission of nociceptive signals from small diameter A-delta and C fibers. Supraspinal mechanisms involving the endogenous opioid system have also been described. Several types of TENS applications, differing in frequency, amplitude, pulse width and waveform, are used in clinical practice. The two most common application modes include: 1) high frequency or conventional TENS (40 to 150 Hz, 50 to 100 usec pulse width, low intensity) and 2) low frequency or so

called acupuncture-like TENS (1 to 4 Hz, 100 to 400 usec pulse width, high intensity). Conventional TENS is associated with a faster onset and shorter duration of analgesia compared to acupuncture-like TENS. Adverse reactions reported with TENS include skin irritation at the site of electrode placement. TENS is contraindicated in patients with cardiac pacemakers due to the potential of interfering with pacemaker activity.

Self-Controlled Energy Neuro-Adaptive Regulator (SCENAR): It was first invented in Russia in mid 80s under space and military research program. SCENAR device generates electrical impulses that are physiologically similar to neuroimpulses. In response to a SCENAR impulse, reflex biofeedback proceeds at real time and biological speed. By continuously using biofeedback, the SCENAR modifies each successive input signal to either amplify or dampen the form of the pathological signals that exist in the body. Pain is the most common complaint to be dealt with in the SCENAR therapy by block of transmission of the pain impulses in the nerve endings of the peripheral nerve fibers, pain focus suppression of brain cortex, and reduction of the edema around the nerve fibers leading to reduction of pressure effect. SCENAR therapy is contraindicated in patients with cardiac pacemakers due to the potential of interfering with pacemaker activity.

SCENAR therapy can be differentiated from TENS. They use electrical stimulation. However, the pulse of the SCENAR device is bipolar and has short triangle and high amplitude. The electrodes of SCENAR device were fixed.

In our series, the result of SCENAR therapy was good in patients with spinal pain, especially in case of acute sprain. But, neuropathic pain including failed back surgery syndrome satisfactorily did not improve. There were no significant complications.

Conclusion

SCENAR therapy is a new therapy for spinal pain. In terms of reflex biofeedback, this device is different from other electrical treatment. Our study suggests that SCENAR therapy would be a very useful method to deal with spinal pain.

References

1. Verhoeven K, Dijk JV. Decreasing pain in electrical nerve stimulation. *Clinical Neurophysiology* 2006; 117:972-978.
2. Khadilkar A, Milne S, Brosseau L, Wells G, Tugwell P, Robinson V, et al. Transcutaneous electrical nerve stimulation for the treatment of chronic low back pain: a systemic review. *Spine* 2005; 30:2657-2666.