



From the torpedo fish to the spinal cord stimulator

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The use of electricity for pain relief has become popular and important in the modern era. Among the various methods using electricity for the treatment of pain, the spinal cord stimulator (SCS) is one of the most advanced and aggressive interventional methods.

Electrical stimulation for pain relief was used in ancient Rome. Since the Roman physician Scribonius Largus found that gout pain had been relieved by incidental contact with a torpedo fish (electric fish) in about 15 AD, the beneficial effect of electrical stimulation on the body has long been recognized [1]. The first electrical stimulator explicitly developed for treatment was 'Electreat', which was marketed to alleviate not just pain but a list of almost every physical problem imaginable. However, the device had many shortcomings, including large size and limited adjustments; therefore, it has been long forgotten [2]. Meanwhile, there have been significant advances in the understanding of pain perception. The concept of 'gate control', introduced by Melzack and Wall [3], was a landmark theory in pain perception. Upon the implementation of gate control theory, 'Electreat' was reinvented and later called TENS (transcutaneous electric nerve stimulation), based on the idea that the sense of touch transmitted by large neural fibers could also be transmitted through the application of gentle electrical stimulation.

The development of the modern TENS device is credited

to Dr. Norman Shealy, who is the pioneer of the contemporary 'neuromodulation' treatment. He devoted himself to research neuromodulation, including TENS, the spinal cord stimulator, and radiofrequency ablation. In 1967, Dr. Norman Shealy had the idea of stimulating the large fibers in the dorsal column of the spinal cord and tried the SCS implantation, which was successful [4]. The first spinal cord stimulator commercially available was introduced via Medtronic in 1968. The early model of SCS required an external power supply connected to the electrode; however, the battery technology had advanced to the point where a fully implantable SCS was available by 1981 [1].

Although it is widely used in many patients with chronic pain, such as post-laminectomy pain syndrome, complex regional pain syndrome, *etc.*, some people have been skeptical about the effectiveness of SCS and reported that it was less effective than expected [5]. However, it has continued to provide substantial pain relief for certain select patients [6].

In this issue of the Korean Journal of Pain, Dr. Isagulyan et al. [7] review the technical advances in SCS. This review describes the technical development of SCS: high-frequency and burst stimulation, dorsal root ganglia stimulation, and wireless and pulse generator-free systems. These technical advances would improve the treatment results in patients with chronic pain. Also, this review will be a

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useful reference for pain physicians.

CONFLICT OF INTEREST

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