CUTTING EDGE™
LASER TECHNOLOGIES

Laser Therapy in Neuropathic Pain

Contents

Neuropathic Pain:
An Underrated Burden

Neuropathic pain is a chronic condition that places a significant burden on both patients and healthcare systems. Compared to other types of chronic pain, neuropathic pain is associated with a lower quality of life.[1]

Although total healthcare costs are difficult to quantify due to variability across underlying diseases, the overall economic impact is believed to be substantial. Furthermore, neuropathic pain leads to psychosocial and emotional challenges, increasing the burden on society.[2]

The magnitude of this problem has become increasingly clear to researchers, clinicians, and industry stakeholders. Since 2000, the number of scientific publications and clinical trials related to neuropathic pain has increased sharply, reflecting a growing effort to better understand and treat this challenging condition.

Despite this attention, neuropathic pain remains difficult to manage. Fewer than half of patients receiving pharmacologic treatments achieve a 50% or greater reduction in pain,[3] and recent estimates suggest outcomes may be even less favorable.[4]

One key reason is that neuropathic pain often arises from multiple pathophysiological mechanisms, while most medications target only a single mechanism. Since patients may experience overlapping types of neuropathic pain, no single drug can adequately address all contributing factors.

These realities highlight the urgent clinical need for new therapeutic solutions capable of meaningfully reducing neuropathic pain and improving quality of life.

1. Epidemiology of neuropathic pain and its impact on quality of life. Smith BH, Torrance N Curr Pain Headache Rep. 2012 Jun; 16(3):191-8
2. Healthcare utilization in people with postherpetic neuralgia and painful diabetic peripheral neuropathy. Dworkin RH, Panarites CJ, Armstrong EP, Malone DC, Pham SV J Am Geriatr Soc. 2011 May; 59(5):827-36.
3. Toward a definition of pharmacoresistant neuropathic pain. Hansson PT, Attal N, Baron R, Cruccu G Eur J Pain. 2009 May; 13(5):439-40
4. Neuropathy: A name for their pain. Eisenstein M Nature. 2016 Jul 14; 535(7611):S10-1

Laser Therapy in Neuropathic Pain

Laser therapy uses focused light energy to target several physiological processes in the body, including:

- Heating the tissues to provide immediate relief from joint and muscle pain and stiffness.
- Promoting local microcirculation to decrease inflammation, edema, and pain symptoms.
- Accelerating cellular metabolism to enhance tissue repair processes and functional recovery.

Due to its effects on pain, inflammation, and edema, laser therapy has become a valuable tool in specialties such as pain management, rehabilitation, and physical therapy.

Neuropathic pain results from damage to the nervous system and encompasses a wide spectrum of conditions, including postherpetic neuralgia, diabetic polyneuropathy, postsurgical neuropathic pain, and spinal cord injury.

A portion of these patients is specifically affected by peripheral neuropathy and seeks treatment that will alleviate pain and improve function associated with conditions that are localized at several body levels: spine, cervical area, elbow, wrist, hand, knee, ankle, foot, and hip.

Given the limited effectiveness and common side effects of pharmacologic treatments, new therapeutic modalities are urgently needed.

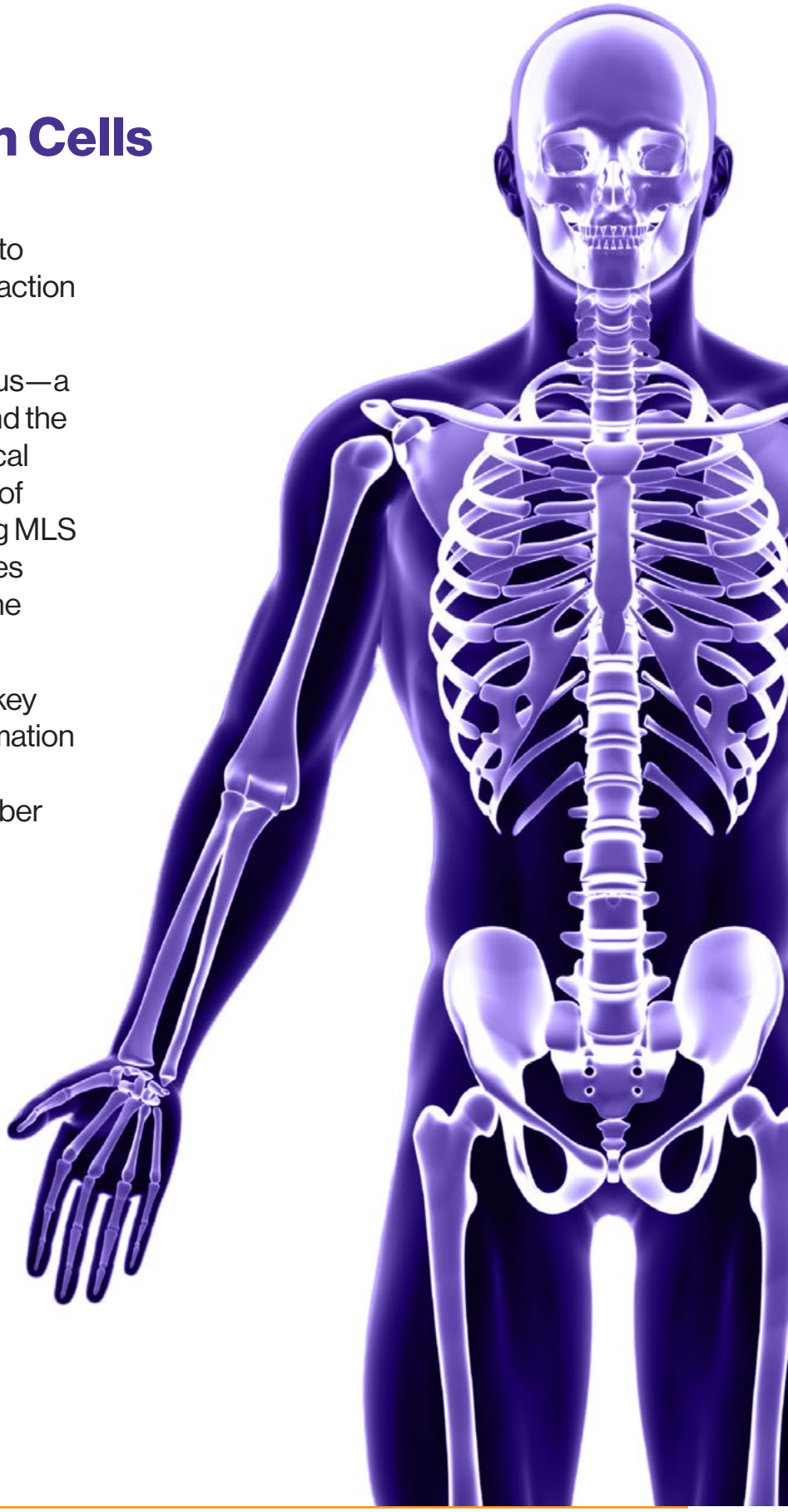
Over the past 15 years, ASA Laser has focused considerable research and development efforts on applying MLS® Laser Therapy to neuropathic pain and related disorders.

Biological Effects on Cells

Studies on cells have been performed to better understand the mechanisms of action of the MLS pulse (Monici *et al*).

Experiments performed by ASAcampus—a joint laboratory between ASA Laser and the Department of Experimental and Clinical Biomedical Sciences of the University of Florence—demonstrated that applying MLS Laser Therapy to muscle cells promotes cellular differentiation and stimulates the synthesis of a broad range of proteins.

Many of these proteins are involved in key biological processes, including inflammation modulation, angiogenesis, muscle contraction, and, most notably, nerve fiber regeneration.



Animal Model Studies

- **Preliminary Investigation in Peripheral Nerve Repair**, Gigo Benato *et al*
- **Experiments on Spinal Cord Injury**, Svobodova *et al*
- **Experiments on Neuropathic Pain**, Micheli *et al*

Primary Investigation in Peripheral Nerve Repair

Gigo Benato *et al*

Following peripheral nerve transection, several surgical techniques are used to repair the damaged nerve. In addition to the surgical procedure itself, postoperative rehabilitation is critical for successful recovery.

A group of Italian and Brazilian researchers (Gigo Benato *et al*) evaluated the role of laser therapy in a rat model of peripheral nerve repair.

After surgically suturing transected nerves, animals were assigned to four groups: placebo, continuous 808 nm laser, pulsed 905 nm laser, and combined pulsed–continuous laser therapy.

Results showed that laser therapy produced statistically significant improvements in:

- Recovery of the lesioned function.
- Recovery of muscle mass.
- Myelination of the regenerated nerve fibers.

Among the treatment groups, the combined pulsed–continuous laser produced the best outcomes. These findings contributed to the development of the concept of using MLS Laser Therapy as a promising modality for early postoperative rehabilitation following nerve suture surgery.

Experiments on Spinal Cord Injury

Svbodova *et al*

In 2019, *Scientific Reports*, a prestigious peer-reviewed journal, published a study evaluating the effects of the MLS pulse on spinal cord injury (SCI) in rats conducted by an interdisciplinary group of researchers from the Czech Republic and the United States.

SCI is a severe condition with limited treatment options.

After the initial injury, which is physically disruptive to cells and tissue (primary injury), a strong inflammatory reaction occurs at the site of the lesion (secondary injury).

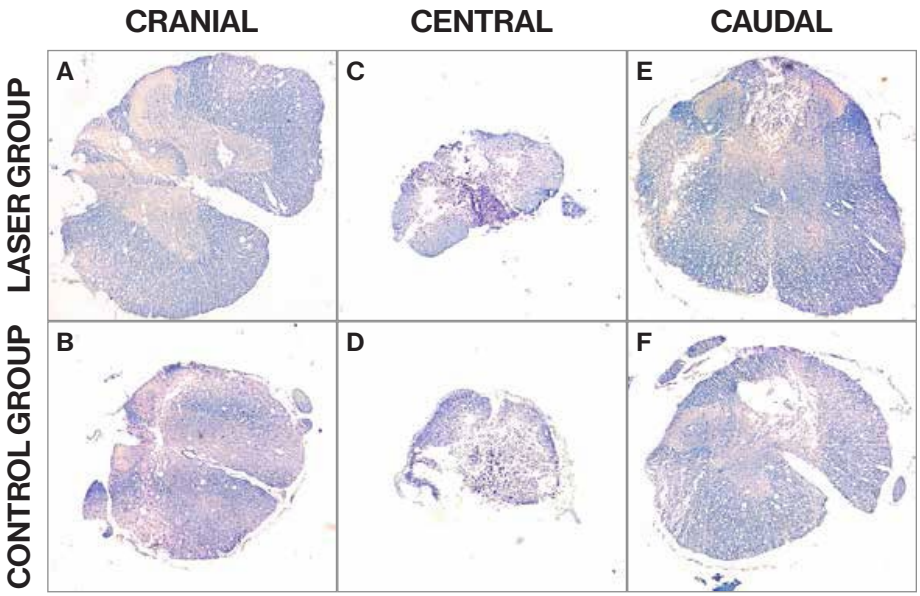
Macrophages play a central role in this inflammatory cascade and may adopt either a pro-inflammatory (M1) or anti-inflammatory (M2) phenotype; after SCI, most macrophages are activated in the M1 type.

In this study, the animals receiving MLS Laser Therapy were compared to untreated controls. All animals were monitored over a 9-week period, and the results obtained by the two groups were compared.

The animals treated with MLS Laser Therapy demonstrated:

- Significantly improved functional recovery, with the treated rats demonstrating better locomotor recovery of coordination and motor function.
- Reduced post-injury plantar hypersensitivity.
- Significantly counteracted muscle atrophy caused by decreased muscle activity.
- Greater preservation of spinal cord gray and white matter.
- A shift in macrophage populations toward the anti-inflammatory M2 phenotype.

These findings suggest MLS Laser Therapy may offer a promising therapeutic approach to improve functional recovery and tissue preservation after spinal cord injury.



Svobodova B., Kloudova A., Ruzicka J., Kajtmanova L., Navratil L., Sedlacek R., Suchy T., Jhanwar-Uniyal M., Jendelova P., Machova Urdzikova L. (2019). The effect of 808nm and 905nm wavelength light on recovery after spinal cord injury. Nature Scientific Report, 9:7660

Histological Analysis

(**A**, **B**) Representative images of Luxol-Fast Blue and Cresyl Violet stained cross sections 9 weeks after the SCI.

(**A**) – laser group, (**B**) – control group.

(**C**) Morphometric measurement of gray matter sparing showed a preservation of the tissue throughout the whole analyzed part of the spinal cord with significance 4–5 mm cranially and 3–7 mm caudally from the epicenter.

(**D**) White matter was also more spared with significance 3–6 mm cranially and 4–7 mm caudally from the lesion center.

Experiments on Neuropathic Pain

Micheli *et al*

Scientific Reports also published a study conducted by ASAcampus investigating the effect of MiS Laser Therapy in a model of chronic constriction injury (CCI) of the sciatic nerve in rats.

This experimental model was chosen because it mimics the neuropathic pain experienced by patients with chronic degenerative nerve damage, for which there is a need for effective therapies.

Three groups were studied:

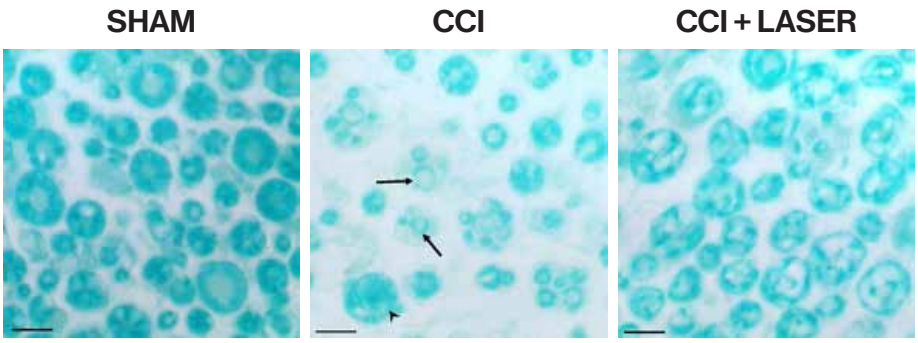
- Sham (animals that received sham surgery, with nerve exposure without ligation.)
- CCI (animals subjected to the ligation of the sciatic nerve, not treated with MiS Laser Therapy.)
- CCI + Laser (animals subjected to the ligation of the sciatic nerve, treated with MiS Laser Therapy.)

The results demonstrated that treatment with MiS Laser Therapy significantly reduced pain and protected nerve structure.

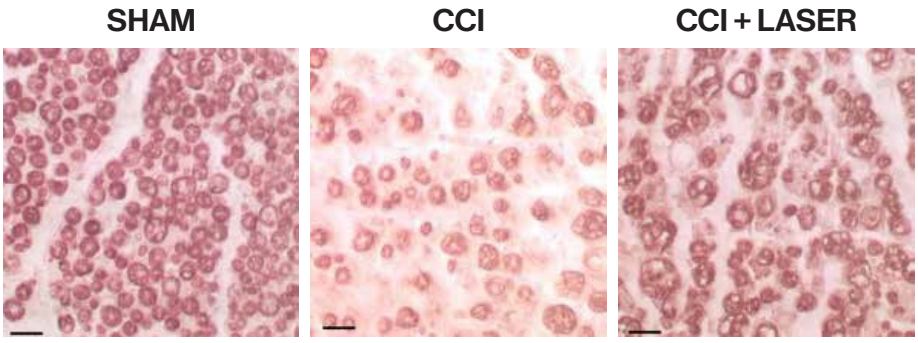
Observed mechanisms included:

- Anti-inflammatory effect, by inhibition of enzymes involved in the inflammation process.
- Repair effect, involving myelin sheath restoration.
- Protective effect on central nervous system, modulating pain stimulation signaling.

This data suggests that MiS Laser Therapy can be a promising therapeutic strategy for managing neuropathic pain following nerve injury.



Luxol Fast Blue staining. Representative micrographs of sciatic nerve axons in a sham, CCI and CCI + laser groups showing a partial laser-dependent neuroprotection of myelin thickness. Original magnification 400 X. Scale bar = 20 µm.



Myelin Basic Protein (MBP) expression. Protein expression of MBP was evaluated by immunohystochemistry in each experimental group. CCI group and CCI + laser group were compared to each other and with sham group. Original magnification 400X. Scale bar = 20 µm.

Clinical Experience on Patients

- **Clinical Experience on Diabetic Neuropathy**, Khamseh *et al*
- **Clinical Experience in Radiculopathies**, Grennell, Perez *et al*
- **Clinical Experience in Lumbosacral Sciatic Pain**, Guzman *et al*
- **Clinical Experience in Trigeminal Neuralgia**, Olmos
- **Preliminary Clinical Results Using MiS Therapy in Peripheral Neuropathy**, Mezzalira, D'Angelo

Clinical Experience in Diabetic Neuropathy

Khamseh *et al*

Diabetes is the most common cause of peripheral neuropathy.

According to the Foundation of Peripheral Neuropathy, 30 million Americans suffer from some form of neuropathy, and 60 to 70% of those individuals (18 to 21 million people) have diabetic peripheral neuropathy.

These patients experience a wide range of symptoms and patterns of nerve involvement. Pharmacologic treatments often provide insufficient relief and are frequently associated with side effects.

Researchers at the University of Tehran evaluated patients with diabetic neuropathy using nerve condition studies (NCS) before and after MLS Laser Therapy treatment. NCS is a medical diagnostic test commonly used to assess the ability of electrical conduction of sensory and motor nerves.

Following MLS Laser Therapy, patients demonstrated significant increases in neural potential amplitudes, indicating improved nerve function in diabetic neuropathy.

These findings support the use of MLS Laser Therapy in diabetic patients with peripheral neuropathy.

Clinical Experience in Radiculopathies

Grennell, Perez *et al*

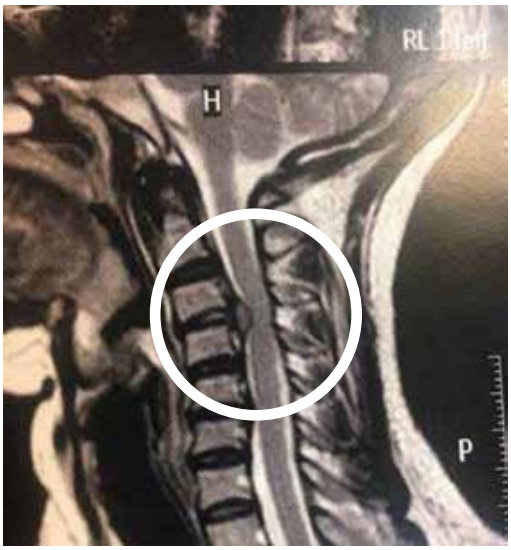
Back pain may have many causes, and the associated pain can manifest at the site of injury and/or radiate through the affected nerve.

Grennell reported the case of a 17-year-old patient with severe lumbalgia and radiculopathy due to an L4–L5 disc herniation. The patient experienced progressive pain reduction over a seven-month treatment period with MLS Laser Therapy. At nine months, symptoms had fully resolved. This early clinical experience suggests MLS Laser Therapy may be beneficial in patients with disc-related radiculopathy.

A separate case study published by Perez, *et al*. highlighted cervical radiculopathy that improved significantly following MLS Laser Therapy. Not only did MLS Laser Therapy provide an effective non-invasive approach to manage cervical pain, but the remarkable result observed was the successful outcome on the spinal cord narrowing (photographed).

Since the regression of herniated discs is thought to occur via an inflammatory reaction led by macrophages, the authors suggested that MLS Laser Therapy could be a useful method to facilitate this process.

SAGITTAL MRI PRE-TREATMENT



SAGITTAL MRI AFTER MLS TREATMENT

Clinical Experience in Lumbosacral Sciatic Pain

Guzman *et al*

Associated with spine degeneration, lumbosacral sciatic pain can significantly impair a person's daily life and activities. Pain not only affects the lumbar zone but also irradiates down the lower limb, limiting flexibility, mobility, and overall physical function

Conservative treatment typically includes anti-inflammatory medications and various physical therapy approaches. Severe cases may require surgical intervention.

A case series evaluating MLS Laser Therapy for patients with lumbosacral sciatic pain found improvements in pain as well as functional abilities, therefore improving overall quality of life.

The treatment was effective in maintaining pain relief between treatment sessions, supporting the usefulness of MLS Laser Therapy as a conservative treatment option for lumbosacral sciatic pain.

Clinical Experience in Trigeminal Neuralgia

Olmos

Olmos published a compelling case report on trigeminal neuralgia of the lingual nerve in a patient who also suffered from chronic pain and obstructive sleep apnea (OSA). Previous treatment with anticonvulsant medication had been unsuccessful.

The multimodal treatment plan included oral appliance therapy, MLS Laser Therapy, and continuous positive airway pressure (CPAP).

After treatment, the patient experienced complete resolution of chronic pain and was able to discontinue medications. At the two-year follow-up, he remained pain-free.

This case highlights the potential of MLS Laser Therapy, particularly when combined with management of OSA and bruxism, as part of a comprehensive approach to long-term neuropathic pain relief.

Preliminary Clinical Results using MiS Therapy in Peripheral Neuropathy

Mezzalira, D'Angelo

Based on promising results in the field of neuropathic pain, ASA Laser developed MiS, a medical device utilizing the MLS pulse specifically designed for patients with peripheral neuropathy.

Two physiotherapy centers reported preliminary clinical experience with MiS in 43 patients (ages 23 to 85; mean age 53) with neuropathic pain affecting various anatomical regions.

Both pain (VAS score) and functionality (therapist evaluation) showed notable improvement by the end of the treatment series. Pain severity consistently decreased, and functional mobility improved, indicating that MiS is a safe, effective, and well-accepted therapy for peripheral neuropathy.

MiS is a result of a deep understanding of the therapeutic potential of the MLS pulse pattern, inheriting its proven wavelengths, synchronized modulation of continuous and pulsed emissions, safety, efficacy, and mechanisms of action.

VAS Pre and Post Treatment Divided by Anatomical Distribution of the Treated Areas

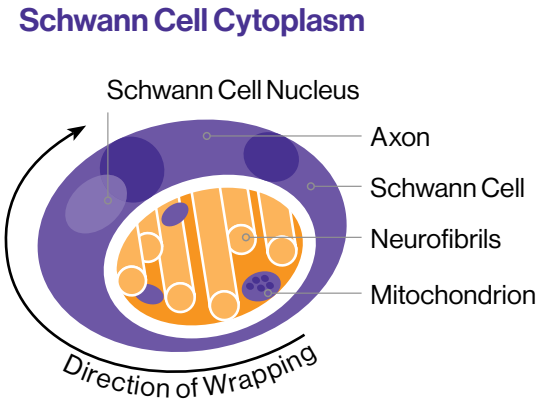
AREA	PATIENT #	VAS PRE (MEAN)	VAS POST (MEAN)	ΔVAS%
Spine	17	8.8	2.2	75.0%
Cervical Area	3	8.3	3	63.9%
Elbow	4	9	0	100.0%
Knee	4	8	1.5	81.3%
Ankle/Foot	3	7	2	71.4%
Hip *(mainly pudendal nerve)*	9	7	0	100%
Shoulder	1	9	0	100.0%
Wrist/Hand	2	7.5	2.5	66.7%
TOTAL	**43**	**7.8**	**1.6**	**79.5%**

Improving Outcomes for Neuropathic Pain

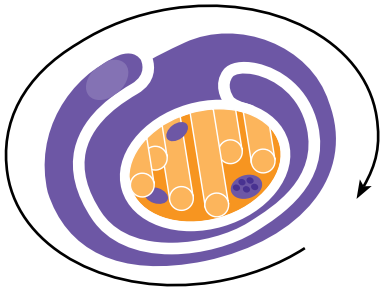
Scientific studies have shown that the MiS Therapy Laser transcends the MLS platform with technological advancements that introduce new therapeutic effects and expand the possible applications of laser therapy to conditions with substantial societal impact.

Based on the evidence presented, Cutting Edge Laser Technologies recommends MiS Laser Threapy as a valuable treatment option for patients with neuropathic pain.

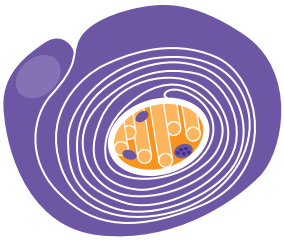
▸ Learn more about MiS Laser Therapy at CELasers.com



Schwann cell wraps around the axon.



Schwann cell rotates around the axon forming layers.



Myelin shealth is formed.

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