

Peripheral Nerve Stimulation

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Peripheral nerve stimulation, frequently referred to as PNS, is a commonly used approach to treat pain. It involves a procedure that places a small electrical device (a wire-like electrode) that targets a named nerve or branch of a named nerve. (These are the nerves that are located beyond the brain or spinal cord). The electrode delivers electrical pulses to provide therapy either to create tingling (paresthesia) or non tingling (non-apresthesia) or a muscle response.

With the evolution of imaging modalities like Ultrasound the scope of PNS has increased markedly for upper and lower extremities, cranial, occipital, lumbar, sacral, genitofemoral, ilioinguinal, axial and segmental nerves. The ability to place leads percutaneously near the neural fascicles without open dissection has significantly reduced morbidity of scarring and the mechanical challenges of previous surgical systems. (1-3). The procedure is primarily done in office setting under local anesthesia.

Peripheral Nerve Stimulation continues to evolve with accrual of more robustly designed studies. Several trials have been published in the last decade to further advance our understanding of this novel therapy with potential new targets (4).

Applications of PNS:

1. Analgesia
2. Bowel Incontinence (sacral nerve stimulation)
3. Bladder Incontinence (sacral nerve stimulation, Posterior Tibial Nerve Stimulation)

Some of the accepted and relatively well studied targets for PNS can be succinctly discussed in the following table.(5,6,7)

	<u>Regions</u>	<u>Peripheral Nerves</u>
1.	CRANIAL	1. Occipital Nerve 2. C2 Post-ganglionic nerve
2.	OROFACIAL PAIN CLUSTER HEADACHE	1. Sphenopalatine Ganglion 2. Supraorbital nerve 3. Infra orbital nerve
3.	UPPER EXTREMITY	1. Median Nerve 2. Ulnar Nerve 3. Radial Nerve 4. Brachial Plexus 5. Suprascapular nerve 6. Axially nerve
4.	THORACIC & LUMBAR	1. Intercostal Nerves 2. Cluneal Nerves 3. Dorsal Cutaneous nerves of cervical, thoracic and lumbar spine
5.	PELVIC	1. Ilioinguinal nerve

		2. Iliohypogastric nerve 3. Genitofemoral nerve 4. Pudendal nerve
6.	LOWER EXTREMITY	1. Lateral Femoral Cutaneous Nerve 2. Peroneal Nerve 3. Saphenous Nerve 4. Post Tibial Nerve 5. Sciatic Nerve

SPINAL NERVE ROOT STIMULATION		
Category	Appropriate Level	Advantages
Intraspinal	C2-Coccygeal	Can target multiple roots per electrode
Transforaminal	Caudal thoracic-sacral	Less likely to undergo migration than intraspinal placement
Extraforaminal	Sacral	Less invasive technique for targeting bladder roots
Trans-spinal	C2-S1	Unaffected by epidural scarring, stenosis or fusion at adjacent levels

There are also published reports with successful use of PNS in a HYBRID neurostimulation paradigm for primarily axial low back pain in conjunction with Spinal Dorsal Column Stimulation (8,9).

The risks and benefits of the procedure should be individualized as per the comorbidities of patients and shared decision making should be encouraged in high risk patients (anticoagulation, high risk for infection, immunocompromised, cancer, etc).

The field of peripheral nerve stimulation is undergoing metamorphosis at a very rapid pace. Advancements into new indications, new stimulation targets and new device designs will expand the window of opportunity to attract more neuromodulators interested in the field of Peripheral Nerve Stimulation. The turning point, however, will not occur until sufficient scientific evidence is gathered to unequivocally prove its safety, clinical efficacy and cost effectiveness (10)

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