

## Median Nerve Stimulation – Wakes up the Brain

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To: Dr Mal Hooper

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*'Dear Dr. Mal Hooper,*

*My friend Gregory Sioris in New York forwarded me your newsletter about Australian based Hyperbaric Oxygenation and Lokomat NeuroRecovery. I am beginning to read the information, mainly with interest in HBO for TBI (Traumatic Brain Injury) and HIE (Hypoxic Ichaemic Encephalopathy).*

*Gregory and I thought you might want to see my UK article about right median nerve stimulation for brain injury, and parallels to TENS for Alzheimers. That research on AD has been done in Amsterdam for years by the neuropsychologist, Dr. Erik Scherder.*

*Please send me an article on the results of your HBO for anoxic brain injury. Hopefully, e-stim will provide another switch for you to communicate with injured brains in an idling state.*

*Thanks,*

*Ed Cooper'*

### What is TENS - Median Nerve Stimulation?

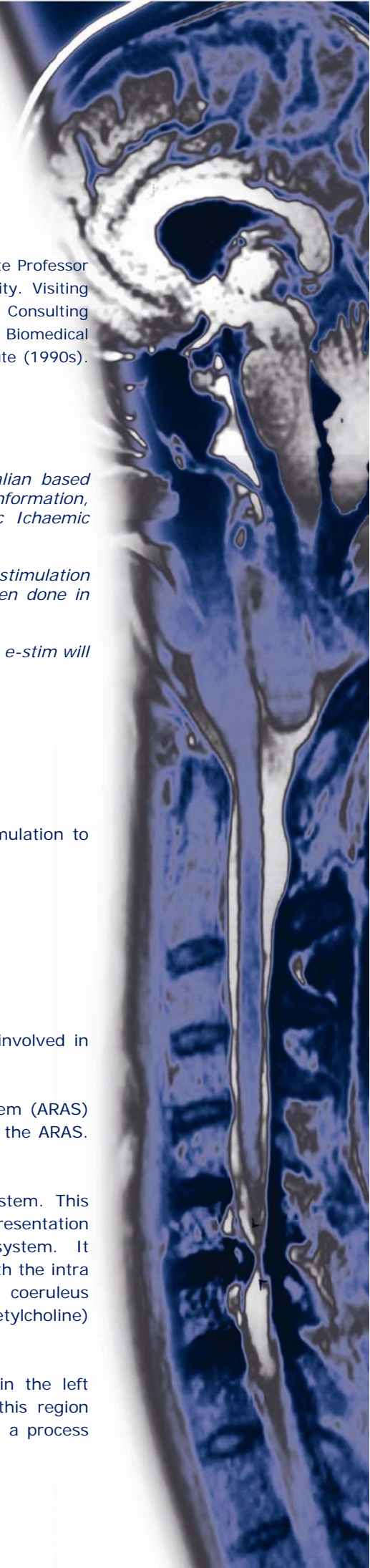
Recent studies demonstrate TENS (Trans Electrical Nerve Stimulation) electrical stimulation to the median nerve:

- Increases cerebral blood flow – measured by SPECT scans and fMRI
- Hastens awakening from coma
- Improves speech
- Increases cerebral activity
- Facilitates neural responses in damaged cortex
- Improves vigilance, motor and emotional responses, and
- Elevates cerebral spinal fluid catecholamine (especially dopamine, which is involved in maintenance of consciousness and motor control)

Median nerve stimulation brings new input to the ascending reticular activating system (ARAS) via the spinoreticular component of the median nerve synapsing with the neurons of the ARAS. Therefore, another means to maintain wakefulness exists!

The median nerve serves as a peripheral gateway (window) to the central nervous system. This is reflected in the fact that the sensory distribution of the hand has a large cortical representation in the brain. Median nerve stimulation seems to activate the entire central nervous system. It is proposed that this peripheral stimulus goes to the ARAS, which further connects with the intralaminar nuclei of the thalamus and then stimulates the cortical layer; the locus coeruleus (releasing norepineprine), and the forebrain basal nucleus of Meynert (releasing acetylcholine) and is also involved in cortical layer I, enhancing arousal.

Better speech appears to be the result of Broca's motor speech planning area, in the left frontotemporal region, being stimulated. Position emission tomography (PET) of this region became more active when a subject moves, or even contemplates moving his hand, a process mimicked by stimulation of the right median nerve.



Test results showed improvement in 42.9% of the patients documented by improvement in EEG. All had 20% increase in cerebral blood flow as measured by SPECT, and a more active metabolism of catecholamines.

In these studies the median nerve was stimulated for six hours daily. We are recommending thirty-sixty minutes daily. The stimulator used in these original studies was a device that produced a constant wave form. We suggest the use of a different stimulator that constantly changes the wave form; thereby, increasing brain awareness by ruling out accommodation and allowing a shorter treatment time. (See the diagram for appropriate electrode placement).



## Median Nerve Stimulation

**"Waking Up" the Brain** Traumatic brain injury, stroke, drowning, autism, cerebral palsy and virtually all neurodegenerative conditions are directly influenced by hypoxia (lack of oxygen) causing decreased brain activity (non functional neurons) and a coma like state. Complex neurovascular injury will result in a coma-like state due to hypoxia; recovery and normal development are directly affected. Median Nerve Stimulation facilitates 'neuroplasticity' and should be part of the rehabilitation process stimulating these patients to "wake up."

**Why Electrical Stimulation Might Work** Electrical stimulation has been used in medicine for treating pain, spinal cord injuries, dementia states and even Alzheimer's Disease. Generally, there is a low-flow current applied through electrodes into the area of injury i.e. low back pain or tennis elbow. Studies have shown that patients with brain and spinal injuries also show improvement from the use of electrical stimulation. It is thought that the electricity travels up into the brain and "wakes up" various areas along the way.

**Attaching the Stimulator to the Right Arm** The median nerve of the right arm was chosen as the way to deliver stimulation for several reasons. The arm is controlled by quite a large portion of the brain. So, by using the arm, we can reach a major part of the brain. In addition, the nerve of the right arm leads into the left side of the brain, where most people control their speech and language.

**Median Nerve Stimulation (MNS) is an inexpensive modality and we recommended daily application for all patients suffering neurodegenerative disorders.**

**MNS is also applied whilst the patient is on the Lokomat to facilitate 'higher' neurovascular responses to the spinal cord, brain stem, cerebellum and motor cortex of the brain.**

## Electrical treatment of reduced consciousness: Experience with coma and Alzheimer's disease

E. B. Cooper, E. J. A. Scherder, and J. B. Cooper.

The right median nerve can be stimulated electrically to help arouse the central nervous system for persons with reduced levels of consciousness. The mechanisms of central action include **increased cerebral blood flow and raised levels of dopamine**. There is 11 years of experience in the USA of using nerve stimulation for acute coma after traumatic brain injury. There is a much longer period of experience by neurosurgeons in Japan with implanted electrodes on the cervical spinal cord for persons in the persistent vegetative state (PVS). But the use of right median nerve electrical stimulation (RMNS) for patients in the *subacute* and *chronic* phases of coma is relatively new. Surface electrical stimulation to treat anoxic brain injury as well as traumatic brain injury is evolving. Novel applications of electrical stimulation in Amsterdam have produced cognitive behavioural effects in persons with early and mid-stage Alzheimer's disease employing transcutaneous electrical nerve stimulation (TENS). **Improvements in short-term memory and speech fluency** have also been noted. Regardless of the aetiology of the coma or reduced level of awareness, electrical stimulation may serve as a **catalyst to enhance central nervous system functions**. It remains for the standard treatments and modalities to **retrain the injured brain emerging from reduced levels of consciousness**.

## Median Nerve Stimulation Background

The right median nerve is a peripheral portal (window) to the central nervous system. The sensory representation of the hand in the cortex is disproportionately large compared to other parts of the body. In the brain stem the ascending reticular activating system (ARAS) maintains the state of wakefulness. The spinoreticular component of the median nerve pathway synapses with neurons of the ARAS (Parent, 1996). **Improvement of level of consciousness**, whether in persons in acute coma, or those in a chronic vegetative or minimally conscious state, is driven by the electrically induced elevation of dopamine and norepinephrine (Hayashi, 1997; Moriya et al., 2000). **Increase in cerebral blood flow**, which is measurable shortly after starting the median nerve stimulation (MNS), is another important factor in neurostimulation for re-awakening (Liu et al., 2003). The **right median nerve was chosen as a portal to stimulate the brain stem and cerebrum** because **increased awareness and a better pattern of speech and abilities to calculate** have been observed after right median nerve electrical stimulation (RMNS) (Cooper & Cooper, 2003; Cooper, Jane, Alves, & Cooper, 1999). In the majority of individuals, whether right handed or left handed, Broca's motor/speech planning area is in the left frontotemporal region. **Broca's area has been shown to become more active** in positron emission tomography (PET) when a subject moves his/her hand, or even contemplates speaking or moving the hand (Montgomery, 1989). This process is also artificially driven by RMNS (Cooper & Cooper, 2003; Spiegel et al., 1999). © 2005 Psychology Press Ltd

**Also review the file [Electrostimulation World Experience - Prof Ed Cooper.pdf](#)**