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## **Stimulating the Nerves**

### **The Spinal Reflex**

There are several pathways that are well recognized functioning peripherally through a spinal cord reflex. The first well known pathway and easiest to understand is the deep tendon reflex. An example of this would be the response when the stretch receptors in the patellar tendon are stimulated though a tap on the knee with the reflex hammer. The signal is sent to the spinal cord where it has complex interactions with other nerves including motor nerves and returns to the quadriceps muscle as a stimulating brief contraction. Another reflex is a sensory nerve-vasodilatation response. It can be elicited by the simple maneuver known as a friction rub. A person vigorously rubs the skin of their arm with a coarse terry cloth for 30 seconds. Increased blood flow occurs in the arm with vasodilatation and pink skin. Blood flow is regulated through arteries and capillary beds by nerves which are influenced through the spinal reflex. MicroVas treatments cause almost immediate dilation of arteries and capillary beds raising blood flow and oxygen levels as measured by transcutaneous oxygen monitors. Interestingly, when one limb is treated there is a mild response in the paired untreated limb as well including improved blood flow. This effect is felt to be from various reflexes through the spinal cord from one limb to the other. The observation has been most dramatic in treatment of Raynauds Phenomena which is characterized by intense peripheral vasospasm mediated to a great degree through the nerves. MicroVas treatment results in fairly rapid pronounced flushing of the circulation. Because of the additional benefit observed to the opposite limb through the spinal reflexes MicroVas treatments are recommended to be given bilaterally whenever possible, even when the problem is unilateral. Then both limbs are receiving both the local effect of the treatment and the spinal reflex influence from the opposite side. Because MicroVas treatments have a variety of effects on virtually all the tissues, there are probably influences through the nerves including the spinal reflex, which are not well understood or identified yet.

### **Nerves Stimulating Skin Regeneration**

Consider another type of nerve mediated effect on the skin, a “nerve-skin reflex”. The cutaneous sensory nerves regulate the thickness of the overlying protective epidermis by secreting growth factors that accelerate the growth rate of the skin. For example; when a person does manual labor with their hands they accelerate the wear of the skin which results in its thinning. The nerves then become more sensitive because of the loss of the protective epidermis. The nerves secrete growth factors and the skin thickens often resulting in protective calluses. There are some disease conditions where this reflex is over stimulated such as Neurodermatitis or Contact Dermatitis. A vicious scratch-itch cycle can result in thickening or lichenification of the skin. These conditions demonstrate how potent this nerve reflex can be. Nerves in the body do much more than sensory and motor functions, they control many other functions not well understood including growth, healing and repair by sensing the need and releasing a variety of hormones that influence these functions. It is felt that MicroVas stimulation of the cutaneous nerves may stimulate this reflex and promote the release of growth factors by the nerves. There is usually a pronounced response in the development of granulation tissue and epithelialization when using MicroVas therapy to promote wound healing. In many cases the granulation tissue that forms in the base of the wound



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becomes rapidly thick and elevated above the surface of the skin. It also epithelializes quickly. MicroVas is a very effective modality to aid in the healing of difficult decubitus conditions. To get the best response when treating various decubitus conditions it is best to place a large pad directly over the area using the “wet pad” setup and keep the current low so as to not cause pain for the patient. In addition treat the condition regionally and bilaterally in the usual fashion.

### **Nerves Generating Nitric Oxide**

The enzyme to produce Nitric Oxide in the body is called NOS (Nitric Oxide Synthetase). It is present primarily in smooth muscle, nerves and the linings of arteries. When the artery linings generate Nitric Oxide the smooth muscles in their walls relax and they dilate. Autonomic nerve fibers regulate blood pressure and flow by directly stimulating blood vessels to dilate or constrict through the alpha and beta receptors. Influencing these receptors has been the mechanism of action of many blood pressure medicines over the years. On the other hand, Nitroglycerine tablets dilate the arterial circulation by being converted in the body to Nitric Oxide, (a gas molecule similar in size to Oxygen) and diffusing throughout the body via the circulation. More recently it has been discovered that nerves can trigger arteries to dilate by generating Nitric Oxide and releasing it at their endings. MicroVas stimulation of the nerves and the consequent release of Nitric Oxide in the tissues is felt to be one of the mechanisms by which increased blood flow and oxygen levels in the tissues occur. When using MicroVas therapy to treat cases of severe arterial insufficiency such as a pulseless blue foot that is at risk of amputation it best to initially treat with an aggressive schedule of 1 or 2 treatments per day for the first 2 weeks to get the patient out of danger. Then the patient may follow a standard schedule of 3 treatments per week. It is helpful to use some nitropaste on the skin between treatments to aid in the circulation while stimulating the remodeling of the vasculature.

### **Stimulating the Nerves to Improve their Function**

There are a variety of conditions where the nerves do not function properly because of various stresses. The nerves may discharge irregularly or not at all. When peripheral nerves are affected the resulting condition is peripheral neuropathy. The stresses can be metabolic in nature such as hyperglycemia of Diabetes. MicroVas electrical stimulation depolarizes the nerve membranes repeatedly forcing them to discharge. This results in increased metabolic activity in the nerves which can correct the metabolic derangements and restore proper function in many cases. This requires many treatments and much patience and persistence. In the course of recovery of various forms of peripheral neuropathy most patients experience an increase in abnormal function of the nerves before normal function is recovered. In other words, when patients begin treatments for a severe case of peripheral neuropathy characterized by a significant loss of sensation, they will go through a phase of increased pain and tingling as nerves that were not firing previously, begin firing irregularly. This increased pain typically peaks around 12 treatments. Pain is usually fully resolved around 24 treatments and the patient usually reaches their best recovery around 36 treatments. Restless leg syndrome is a condition that is often associated with peripheral neuropathy. Whereas peripheral neuropathy is characterized by abnormal signal transmission in the peripheral nerve, Restless Leg Syndrome is characterized by abnormal signal processing in the spinal cord resulting in abnormal spinal reflexes. MicroVas treatments not only stimulate the peripheral nerves but appear to promote recalibration of the reflex pathways through the spinal



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cord as well. Patients treated for Peripheral Neuropathy usually experience an improvement in their Restless Leg Syndrome along with the Peripheral Neuropathy.

### **Autonomic Nerve Stimulation**

The sensory nerves generally run subcutaneously throughout the body and are easy to stimulate since they are close to the surface of the skin. In contrast the autonomic nerves are located deep in the trunk of the body and are more difficult to stimulate. Autonomic nerve dysfunction is often a form of peripheral neuropathy. Examples include Erectile Dysfunction associated with Diabetes and Neurogenic Bladder. These conditions also respond to treatment as sensory nerves do. The MicroVas pads must be placed on the trunk to form the electric field through the body front to back in most cases. The autonomic nerves are best stimulated where they innervate structures near the surface of the body such as the pelvic floor.

### **Principles of Application**

Because of the spinal reflex treat the body bilaterally and symmetrically when able. When stimulating wound healing including skin, treating the area regionally is important and locally with a pad directly over the wound. This is done with a “wet pad” setup because of the transudates that usually form in the wound. The transudates prevent gel pads from sticking and may generate an infection control issue. The “wet pad” setup consists of a thin sterilized sponge soaked in normal saline placed directly over the wound with a carbon electrode above and held in place with Velcro elastic straps. The paired electrode is on the opposite side of the limb. The nerves are often very sensitive without the protective covering of skin and the voltage must be kept at a low setting. A less desirable alternative when the wet setup is not used is to place a pair of gel pads adjacent to the wound on opposite sides in addition to the other standard pads.

When the problem is with the nerve function itself the condition must be treated with up to 36 treatments as the condition responds slowly. Treating autonomic nerves requires placing pads over the areas where the autonomic nerves innervate such as the pelvic floor for the bladder, urethra or prostate. Stimulating the autonomic nerves in the abdomen in association with the organs such as the colon usually gives a mild and variable response with less success overall. (For example; Atonic colon due to autonomic neuropathy from diabetes.) This is probably because of the thickness of the abdomen and the diffusion of the electric field through such a large volume of tissue.

In most conditions placing the pads over the major muscle groups gives the greatest benefit. When the problem also involves nerve function there is benefit in placing the pads over the neurovascular bundle in the area in addition to the major muscle groups (The ankle is an example).