

TRANSNEURAL DEGENERATION: A CRITICAL CONCEPT

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Do you remember what it feels like to be sick in bed with the flu? You feel like you are going to die. You are exhausted and can barely move, but at the same time, highly irritable. If someone comes into your room and flips on the light switch, you might blurt out, "Turn off the lights and leave me alone!" Then you again collapse into your misery.

Remember that feeling and you will understand a neurological process that is not known to many practitioners, but one which is critical to the understanding of many, if not all of our patients at some time or other. It is a process that has become understood clinically through work being taught in the chiropractic neurology program and it is something many other doctors may miss.

IMPORTANT CONSIDERATIONS

D. D. Palmer spoke of "too much or not enough nerve energy." We have learned to use the terms facilitation and inhibition. More recently in the *International Journal of Neuroscience* paper on the neurological model for AK, we have adopted the terms conditionally facilitated and conditionally inhibited to define the phenomena we observe of changes in muscle strength. The process we are discussing here is called transneural degeneration (TND). It is a surprisingly common finding and yet totally different from, although related to, facilitation and inhibition. (Reference: Schmitt, W.H., & Yanuck, S.F. Expanding the neurological examination using functional neurological assessment part II: neurologic basis of applied kinesiology. *Intern J Neuroscience*, 1999, 97, 77-108.

Those of us who are attempting to correlate applied kinesiology (AK) and chiropractic neurology have become aware of the necessity of understanding TND. Most of you have heard of the excellent coma arousal work that Dr. Ted Carrick has done over the past two decades. Dr. Carrick has accumulated experience by bringing thousands of patients out of comas. At first thought, the neuropathy of comatose patients seems far removed from what we need to deal with in our daily practices.

Many years ago, one patient in particular opened the door to my understanding the principles of the process of neurological degeneration. She was a patient in our office with a spastic torticollis, what we have often called a "tonic, clonic, chronic, intermittent torticollis," or in modern terminology what is called "cervical dystonia." After limited success in our office, we referred the patient to Dr. Gail Henry, a chiropractic neurologist in Texas who wrote her neurology diplomate thesis on movement disorders, or dystonias. One of Dr. Henry's therapies was having the patient breathe 100% oxygen as soon as a movement began. The oxygen would stop the movement in its tracks, and within about two weeks, the spastic torticollis was controlled, and soon thereafter the patient was healed. This was most impressive considering what had previously failed to work in our

AK practice.

Basically, TND is the process of neuron degeneration. (It is also the process of neurological development whereby those cells that do not mature eventually die.)

TND may occur for many reasons. It is certainly the process which occurs in brain injury and brain aging. But it is likely present in a large number of our patients. The process is far more common than I had ever thought. In fact, I am finding evidence of TND in more than half of my patients and certainly almost all of my difficult patients.

The scary thing is that many of you reading this also have TND somewhere. If you have problems which recur, in spite of good AK treatment, there is a strong likelihood that you have TND in some motor neuron pool somewhere. That fact is my primary motivator in writing this article.

HOW AND WHY DOES THIS OCCUR?

TND develops when neurons are not metabolically active and deteriorate. There are probably structural, chemical and mental reasons for TND. Chiropractic neurologists like to focus on structural problems, that is, the lack of stimulation from afferent sources. This is called functional deafferentation and has been discussed in past ICAK publications by Dr. Michael Allen, Dr. Richard Belli, Dr. Kathy Power, and others. Afferent stimulation is what neurons depend on for their health.

It is the LACK of cell membrane stimulation (excitation OR inhibition) that leads to TND. TND occurs as a consequence of under stimulation of neuron membrane receptors, which leads to a decrease in second messenger activity and a decrease in stimulation to the cell's nuclear DNA for genetic transcription. This results in decreased protein synthesis resulting in fewer intracellular anionic proteins, hence lowered (more positive) membrane potential bringing the cell closer to threshold for firing. Decreased ATP production is also a consequence of TND. Decreased ATP affects cellular membrane pumps (e.g., the sodium-potassium pump) further allowing the membrane potential to move closer to depolarization threshold. This allows the cell to be easily stimulated (should there be a barrage of receptor activation) resulting in a rapid depletion of nutritional and enzyme substrates. In fact, TND neurons may even fire spontaneously, which was what was happening in our cervical dystonia patient, and likely happens in most dystonia patients.

All of this puts the cell in danger of metabolic overload and death by apoptosis (programmed cell death). However, some neuron pools resist death and exist for long periods of time in this overly irritable, but extremely fatigued state. This is just like you are when you are in bed with the flu – overly irritable but extremely fatigued. Supplying the neuron with oxygen (by having the patient breathe 100% oxygen) *as the cells are being activated* is one way to enhance ATP production to meet the metabolic demand. This procedure may allow the neuron to move away from its depolarization threshold and toward normal membrane potential so it is not so overly sensitive. This is why our cervical dystonia patient responded so remarkably to oxygen. However, oxygen without neuron activation will not alter TND. (In fact, oxygen given to an antioxidant deficient, deafferentated neuron could actually lead to further oxidative cellular injury and even neuronal death.) It is the careful restoration of afferent activity and the supply of oxygen (and possibly other nutrients) that can turn around the TND process.

The effect of TND on muscle testing is that TND neurons will fire enough to create a normal appearing (conditionally facilitated) muscle testing response. This makes normal muscle testing inadequate for identifying TND and the process can continue unnoticed.

Lack of normal range of motion, hence decreased afferent stimulation, from subluxations, muscle imbalances, and immobility following injuries are some common causes which could lead to TND if not treated early and properly.

Because so many people do not receive proper care of their problems through chiropractic and AK, we probably all see a lot of patients who have developed TND by the time that they see us and have ongoing TND somewhere in their central nervous systems.

Neural afferentation is only one manner of stimulating the receptors in cell membranes, albeit one of critical importance. Adequate nutrients must be present. Basic oxidation-reduction requires nutrients for oxidative phosphorylation for ATP production via the citric acid cycle (CAC) and the electron transport chain (ETC) as well as antioxidants for the regulation of oxidation. In AK we are all aware of the importance of supplying these nutritional substances.

Chemical irritants can also disrupt cellular metabolism and decrease ATP. Allergies and other immune system problems deplete antioxidants and produce other metabolites (e.g., nitric oxide) which alter CAC and ETC activity. Heavy metal toxicity in neurons causes TND by readily binding to sulfur groups including lipoic acid which is necessary for CAC activity and ATP production. AK doctors address these and other issues which help to restore neuron health.

TEST WITH OXYGEN

Preliminary observations have been able to correlate some AK findings with chiropractic neurology findings in patients with TND. There is no question that TND is a critical process that we do not detect with traditional AK testing. It typically does not fix itself, but rather persists and slowly progresses. TND is the cause of difficult patients and degenerative processes in our patients and ourselves. If you are not a chiropractic neurologist, adding regular testing with oxygen may give you at least a hint about who these patients are. When testing with oxygen, consider the possibility of TND in addition to the other muscle testing responses to oxygen which have been discussed by Dr. Goodheart and others.

With adequate antioxidant status, patients tolerate oxygen well. Those who have muscle weakness (conditional inhibition) induced upon breathing oxygen have either an antioxidant need and/or adrenal depletion (lowered reducing steroids).

Those who strengthen may have TND present. Having a tank of oxygen in your office is a good procedure should an emergency arise. But regular testing of your patients with a few breaths of oxygen will offer insights into possibilities which may have not been considered in the past.