

THE CONCEPT OF NEURO-AVAILABILITY

By Francois Aubertin, MSc, D.O.

NeuroKineticHealth.com

One of the fundamental element in osteopathic medicine is the notion of *somatic dysfunction*, a mechanical perturbation bringing physiological changes near and at distance of its mechanical origin. The phenomena at the site of the mechanical perturbation are rather easy to explain and corroborate with the somatic dysfunction. Meanwhile, the further away you get from the somatic dysfunction's origin, the harder it is to ascertain a definite relationship between cause and effect(s). The later has been recently openly criticized in literature to the point of threatening or seriously questioning the validity of somatic dysfunction's phenomena and the somatic dysfunction itself as we know it. To remedy this issue, the concept of neuro-availability will open up new perspectives in mapping and discovering the cause and effect links. It may also provide better neurological understanding when teaching the osteopathic mechanical and physiological principles.

Neuro-availability, at the theoretical level, is a neurological concept capable to explain the variability in which symptoms and phenomena interact and manifest in an individual. The relationship between cause and effect(s) follows a defined neurological circuitry via proprioceptive pathways. In the presence of osteopathic somatic dysfunctions and other structural ailments, some of those neural circuits are busy, being used to protect, mostly to avoid pain and discomfort or to compensate postural necessities. Neuro-availability can illustrate the different neuro-physiological strategies the body utilizes to achieve homeostasis. On the practical level, neuro-availability allows the practitioner to verify whether or not the neuro-physiological system was adequately reprogrammed or reseted after the therapy.

This concept will bring a new level of understanding and clarity in the conceptualization and modelization of the interdependences between causes and effects presented by both osteopathic somatic dysfunctions and other mechanical perturbations. With neuro-availability we can now elucidate and explain complex cases of descending and ascending chain interactions throughout the neuromuscular system. We will be able to identify and find the reasons why an identical osteopathic dysfunction may manifest its associated phenomenons differently from one individual to another. I sincerely believe neuro-availability will be a valuable aid in teaching phenomenology in osteopathic medicine.

How neuro-availability came about?

Since I started practicing manual therapy, I have always been fascinated with posturology and I understood the role of muscular imbalances in generating many of our physical issues. In 2014, I purchased my own stabilometric force plate to study the effects of patient's projection of center of gravity and postural leg dominance. At that time I was quite involved with the Crossfit community helping them increase their physical abilities while reducing their injuries. Crossfit athletes were my first examinees.

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It was easy to set-up my stabilometric force plate at their workout place and all were enthusiastic to help me while learning about their postural strategies and dominances.

I wasn't sure what I was going to find and it took a few trials to see all the potential of the stabilometric force plate at hand. I designed a testing protocol collecting data from the force plate about their posture, a soft-tissue palpation of major leg muscles to verify objective tenderness, and a physical assessment to determine the presence of lumbar and sacro-iliac somatic dysfunctions. About after ten participants, I started to observe somewhat of a consistent pattern between the readings of the force plate and the presentation of neuromuscular symptoms in the soft tissues of their legs. It looked like there was a direct link between the postural measurements, the symptomatology in the legs soft tissues, and the causal somatic dysfunctions originating in their lumbar spine, and sacro-iliac joints.

Seeing this consistent pattern I asked myself the question, what if I could come up with an accurate diagram mapping the lesional phenomena of the cause and effect chains in the lower extremity? Such a diagram would simplify my physical assessment routine.

After just a few days of testings, my cause and effects diagram was becoming strikingly accurate. I was able to consistently diagnose, from the somatic dysfunctions observed during the physical assessment, a consistency in the downward neuro-physiological phenomena. The reverse process was also true, identifying the phenomena from the feet up lead to the predictable somatic dysfunctions at the sacro-iliac joints and lumbar spine. I now needed to establish clearer testing parameters and verify my presumptions.

I started the mapping of cause and effect at the sacro-iliac joints considering an anterior superior sacral base on one side and noted the downward neuromuscular effects at the hips, knees and feet. The force plate readings were always the same for a right sided sacro-iliac anterior superior dysfunction; the projection of the center of gravity was slightly to the right as well as the postural leg (I designated the leg dominance as "postural leg" on which 51% or more of the body weight was measured, and "dynamic leg" for the lighter side). I added more testings with the use of a barbell and dynamic motions such as front squats and back squats. Of course the readings started to be more complex when we measured dynamic functional movements but still, the projection of the center of gravity and postural leg were constant. I felt I was observing something important.

Unfortunately, when testing with my sedentary or elderly population the chart somatic dysfunction / associated phenomena was less accurate. Nevertheless, there was still a large portion (about 75%) of the interrelationship cause and effect that was still exact.

To elucidate the inaccuracy in the presentation of cause and phenomena, I embarked on a quest to find out the reasons why the non-athletic population would not follow the chart as did the athletic population. There had to be a reason why the phenomena were not following the exact same pattern as with my athletic population. To find those answers, my starting point was with neurology, especially proprioception.

First, I revisited the latest notions in sensory and motor pathways. Secondly, I realized that I needed to gather more palpatory cues with those people whose symptomatology wasn't following my chart accurately, I started to ask more questions about their past injuries, physical limitations, etc.

Finally, after multiple thorough physical assessments I started to realize where the cause and effect discrepancies came from. I noticed that most of the inaccuracy in the phenomenology came from compensatory measures controlled by the proprioceptive system. In particular, old injuries found mostly in the knee and foot joints. Patients omitted to even mention them as they were no longer consciously aware of them, but nevertheless, neurological protective mechanisms were held in place to avoid pressure, pain, or the utilization of an affected joint in its full range of motion.

Summary of my postural test findings.

Using the stabilometric force plate, I noticed that in young and athletic people the projection of center of gravity and postural leg dominance followed a consistent pattern with the observed lumbar and sacro-iliac somatic dysfunctions and their associated phenomena. Whereas the less athletic and aging population showed an inconsistent cause and effect pattern while maintaining a consistency in the projection of center of gravity and postural leg dominance at about 80%.

Neurological interpretation of my findings, explaining neuro-availability.

Let's quickly review the sensory and motor systems which are relevant for this presentation. The sensory nervous system, or somatosensory system, is a part of the nervous system responsible for processing sensory information. The sensory system consists of sensory neurons including specialized sensory receptors, neural pathways, and parts of the brain involved in sensory perception.

The motor system is the set of central and peripheral structures in the nervous system that support motor functions, i.e. movement. Peripheral structures include skeletal muscles and neural connections with muscle tissues. Central structures include cerebral cortex, brainstem, spinal cord, pyramidal system including the upper motor neurons, extrapyramidal system, cerebellum, and the lower motor neurons in the brainstem and the spinal cord.

The sensorimotor system encompasses all of the sensory, motor, and central integration and processing components involved with maintaining joint homeostasis during bodily movements (functional joint stability). It is at this level that neuro-availability takes place. To simplify my presentation on how neuro-availability plays a role in the sensorimotor system, I will limit my explanations on how it affects the proprioceptive system, which is the most relevant system involved in posture and motor control.

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The proprioceptive system is a constitutive portion of the somatosensory system. It constantly monitors the senses of position and movement of our limbs and trunk, the sense of effort, the sense of force, load or heaviness. Proprioception is mediated by proprioceptors, specialized sensory receptors, mostly mechanoreceptors located in soft tissues like the skin, muscles, tendons and around joints. Another type of sensors involved with proprioception are the nociceptors, they detect different kinds of damaging stimuli or actual damage. Those that only respond when tissues are damaged are known as “sleeping” or “silent” nociceptors.

The proprioceptive system is mostly functioning unconsciously, it collaborates with higher centers of the peripheral and central nervous system for complex movements, in particular our sense of equilibrium and balance.

Constantly sensing afferent sensory inputs, the proprioceptive system takes into account all the information from peripheral receptors, including mechanoreceptors and nociceptors. It sums up, analyzes and sends proper motor stimuli to achieve desired movements, balance or stability. While trying to be as efficient as possible and conserve homeostasis, the efferent stimuli follow motor pathways to inhibit or activate the necessary effectors, muscle fibers. These motor pathways are organized in multiple and variable circuits controlled and modulated to accomplish the desired movements or postural necessities.

In presence of old injuries or arthritic degeneration, even if no pain or discomfort is being consciously somatized, the proprioceptive system is well aware of their existence. It is also true for somatic dysfunction phenomena, especially the secondary and tertiary associated compensatory lesions. These mechanical and nociceptive inputs are taken into consideration when motor efferent stimuli are generated.

When a sensorimotor circuit becomes labeled as “busy” or unavailable. It is logical to assume that the motor system is then forced to use alternative or the next best available pathways to achieve its task. This is where the concept of neuro-availability takes place. To achieve the required motor tasks or adjustments, the motor system utilizes the circuits that are still neuro-available. This circuitry rewiring unfortunately reduces the number of possibilities the proprioceptive system has to carry out all its motor adjustments. I believe neuro-availability can explain the temporary or permanent rewiring used by the proprioceptive system, utilizing the available motor circuits left at hand, even if these circuits were not the first choice of action.

This is what I believe happened when testing the normal versus the athletic population. People with “dormant or silent” joint issues manifested different phenomena. Within their proprioceptive system, some of the circuitry registered busy and the normal expected phenomenology did not follow the same expected pattern as in the athletic population. This is how I can explain the variations in the manifestations of the observed phenomena originating from the same set of sacro-lumbar osteopathic somatic dysfunctions.

Conclusion

The search of the possible reasons why the phenomena were presenting differently between my athletic and normal population brought me a deeper understanding of symptomatology and the inter-relationship between somatic dysfunctions and other present mechanical ailments whether perceived or silent.

At the physical assessment level, I was able to establish a clearer diagram of the most common somatic dysfunctions encountered and their related phenomena. I have completed my diagram for the lumbo-sacral area and recently started a diagram for the neck and brachial plexus.

I realized that a thorough palpation is the key component in finding hidden structural dysfunctions neurologic triggers and because of it I was able to discover consistent key palpatory points that once identified lead to confirm both somatic dysfunctions and other mechanical issues. At the end of the session when assessing these key palpatory points and observing that they have disappeared, it confirms that the neuro-physiological system was adequately reprogrammed or reseted. Since practicing with this new method, patients have less or no recurrences of their issues. My assumption is that a more complete neurological reprogramming or resetting, by reducing most if not all of the afferent faulty inputs, helps the patient to maintain a state of homeostasis for a while longer.

More research is needed to reveal the full implication of neuro-availability but doing so could bring light about the distant neuro-physiological effects of somatic dysfunction and bring a deeper understanding of the inner workings of both phenomenology and physiology of the osteopathic somatic dysfunction.

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PRESENTER: Francois Aubertin, MSc, D.O.

INSTITUTION: NeuroKineticHealth.com

FORMAT: Power-Point Presentation (20 min)

PRESENTATION TOPICS:

- Osteopathic somatic dysfunction; critics in osteopathic / medical articles and reviews
 - Variation in the manifestations of phenomenons from identical somatic dysfunctions
 - The concept of Neuro-Availability; *quick review of proprioception
neurological strategies and necessities
how neuro-availability came about
phenomenology variations explained
concept limitations and ongoing research*
 - How Neuro-Availability may help the teaching of osteopathic principles
 - Question Period
 - Invitation to pursue this research and final words
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