



# Osteopathic Treatments of Post-Concussion Syndrome

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## 1. **Opinion Statement**

Most patients with a concussion recover completely within a 7 to 10-day period, however, approximately 10% will exhibit signs and symptoms of a concussion beyond the usual period. Post-concussion syndrome (PCS) occurs when concussion symptoms continue for months or years after an initial concussion or brain injury. Patients suffering from a concussion frequently go a long time without much hope or support when living with PCS. Symptoms evolve over time and may appear to be caused by something other than the concussion or mild Traumatic Brain Injury (mTBI) resulting in medical doctors looking in other places as the source of the symptoms, other than the brain. As a result, many patients are misdiagnosed and improperly treated for many years with their PCS symptoms persisting and evolving. This paper demonstrates the effectiveness of osteopathic therapies for the treatment of post-concussion syndrome.

## 2. **Introduction**

PCS impacts many, if not all, areas of life, including quality of life. Symptoms can be broken up into four different categories:

- Emotional: irritability, depression and anxiety that can easily be confused with other mental health conditions
- Physical: headaches, neck pain, vision impairment, light or noise sensitivity, dizziness, nausea, digestion problems, hormonal imbalance
- Cognitive: memory problems, finding the right word, difficulty focusing, speech impairment, brain fog
- Sleep: getting too much sleep or not getting enough sleep

Some symptoms, such as cognitive and behavioral changes and sensitivities to noise, may not develop for days or weeks after the injury occurs. The strongest and most consistent predictor of slower recovery from concussion was greater severity of a person's acute and subacute symptoms following injury.<sup>1</sup>

Impact can cause structural damage to the brain or interruption of neural communication.

“Immediately after biomechanical injury to the brain, abrupt, indiscriminate release of neurotransmitters and unchecked ionic fluxes occur ... These ionic shifts lead to acute and subacute changes in cellular physiology. The resulting energy crisis is a likely mechanism for post-concussive vulnerability, making the brain less able to respond adequately to a second injury and potentially leading to longer-lasting deficits.”<sup>2</sup>

### **3. Diagnosing PCS**

There is considerable controversy regarding PCS and whether these patients are experiencing depression, somatization, chronic fatigue syndrome, chronic pain, vestibular dysfunction, or some combination of these conditions. Patients often present with considerable insecurity as to why they are experiencing PCS symptoms, which typically include headache, fatigue, sleep disturbance, vertigo, irritability, anxiety, depression, apathy, and difficulty with concentration. Symptoms are often subtle and difficult to link directly to the head trauma. However, recent research has demonstrated that most individuals complaining of PCS symptoms have neurologic changes as demonstrated by abnormal functional neuroimaging, neurochemical imbalances, and electrophysiological indices of impairment.<sup>3</sup>

Diagnosis of PCS and description of relevant signs and symptoms are best done using the WHO's ICD 10 criteria. The criteria require three or more of the symptoms described in the preceding paragraph.

### **4. Osteopathy Treatments**

#### **4.1. Cranial Sacral Therapy**

CranioSacral therapy (CST) was developed by osteopathic physician, John E. Upledger, a clinical researcher and Professor of Biomechanics at Michigan State University where he conducted extensive scientific studies on CST from 1975 to 1983.

CST uses gentle hand pressure generally no greater than 5 grams, or about the weight of a nickel, to manipulate the skeleton and connective tissues, particularly the cranium and sacrum, to ease restrictions in the movement of cranial bones and associated soft tissues and to stimulate the flow of the cerebrospinal fluid, which bathes all the surfaces of the brain and the spinal cord.

The release of restrictions in the craniosacral system:

- improves the functioning of the central nervous system.
- assist in autonomic nervous system regulation and turn down the sympathetic overdrive.

- help to mobilize the central nervous system and enhance its functioning, and this will have a flow-on effect to all other systems.
- work with the fascial network of the body, and when this is functioning well the person is able to have a better representation in their somato-sensory cortex.
- assist at the interface of the musculoskeletal system and the nervous system, such as at the myodural bridge where tensions through that region can be broadcast up and down the entire dural system.
- increase range of motion (ROM) and strength, improve tolerance for activities of daily living (ADLs), and facilitate a higher quality of life based on functional assessment tools.

The craniosacral system consists of the meningeal membranes, including the dural membranes surrounding the brain and spinal cord, the osseous and fascial structures to which the meningeal membranes attach, the non-osseous connective tissue structures which are intimately related to the meningeal membranes, the cerebrospinal fluid the ventricles and all the structures related to the production, resorption of the cerebrospinal fluid, the meninges and the craniosacral system glia cells.

The brain and spinal cord are covered and protected by layers of tissue called the meninges. The anatomy of the craniosacral system includes the cranial vault, which is lined with the two-layered dura mater, an endosteal layer firmly attached to the inner surface of the skull and an inner meningeal layer.

In some areas, the dural meningeal layer reflects inward and forms partitions, creating the quadrilateral space that houses the brain. The dural tissue or membrane forms a vertical partition that separates and contains the left and right hemispheres of the cerebrum (falx cerebri) and the cerebellum (falx cerebelli). The dura that forms the posterior horizontal partition (tentorium cerebelli) acts as a mezzanine floor of sorts, with the occipital and temporal lobes above and the cerebellum below.

“The falx sits like a mohawk hairstyle between the brain’s two halves and is stiffer than the rest of the brain, like leather versus gelatin. Watching reproductions of the recorded impacts and additional simulations, the researchers saw that hits to the side of the head could produce vibrations in the falx, due to its stiffness. Those could then propagate down to the corpus callosum, creating the kind of tissue strain that is often implicated in concussion.”<sup>4</sup>

The second layer of the meninges is the arachnoid layer, which follows and attaches directly to the dural layer. The innermost meningeal layer, the pia mater, follows the brain contours like shrink wrap. With firm attachments at the foramen magnum and at C2 and C3 segments of the cervical spine, the dural tissue continues caudally to form a tube that surrounds the spinal cord, tethered only by ligaments, until anchoring at the second sacral segment, exiting out of the sacral canal and blending with the periosteum of the coccyx. The dura mater accompanies the spinal nerves as they exit the intervertebral foramina, forming dural sleeves that attach on the vertebral bodies.

The cerebral spinal fluid is located between the arachnoid and pia mater in the sub-arachnoid space. The cerebral spinal fluid surrounds, protects, nourishes and cleanses the brain and spinal cord. It flows within the dural system, around and throughout the brain, where the flow is regulated by glial cells, around the spinal cord to the dural sleeves, and is affected by dural tension.

The deepest layer of the meninges, the pia mater, is firmly connected to the dura mater of the craniosacral system via the arachnoid layer. The innermost surface of the pia mater also has a direct connection to the brain itself. It directly adheres to the brain's matrix of glial cells via glial end-feet that form a membrane layer, called the outer glial limiting membrane.

These direct and significant connections provide a plausible mechanism by which trauma to boney structures lined with dura, as well as connective tissue strain from throughout the body, can be communicated deep into the glial matrix that makes up the brain and supports its vulnerable structures.

Upledger CranioSacral Therapy, along with Jean-Pierre Barral, DO, MRO(F), RPT's Visceral Manipulation and neuromeningeal techniques, applied to these patients with post-concussion syndrome provided significant results for future concussion recovery. Statistically significant, positive changes in cervical range of motion, memory, physical reaction time, quality of life, headache, pain levels and duration of sleep were documented up to three months after the intervention.<sup>5</sup>

#### **4.2. Visceral Manipulation**

Visceral manipulation (VM) was developed by world-renowned French Osteopath and Physical Therapist, Jean-Pierre Barral.

VM assists functional and structural imbalances throughout the body including musculoskeletal, vascular, nervous, urogenital, respiratory, digestive and lymphatic dysfunction. It evaluates and treats the dynamics of motion and suspension in relation to organs, membranes, fascia and ligaments. VM increases proprioceptive communication within the body which relieves symptoms of pain, dysfunction, and poor posture.

Strains in the connective tissue of the viscera can result from surgical scars, adhesions, illness, posture or injury. Tension patterns form through the fascial network deep within the body, creating a cascade of effects far from their sources for which the body will have to compensate. This creates fixed, abnormal points of tension that the body must move around, and this chronic irritation gives way to functional and structural problems. VM uses specific placement of soft manual forces applied to encourage the normal mobility, tone and motion of the viscera and their connective tissues.

There are definite links between somatic structures, such as the muscles and joints, the sympathetic nervous system, the visceral organs, the spinal cord and the brain. For example, the sinuvertebral nerves innervate the intervertebral disks and have direct connections with the sympathetic nervous system, which innervates the visceral organs. The sinuvertebral nerves and sympathetic nervous system are linked to the spinal cord, which has connections with the brain. In this way someone with chronic pain can have irritations and facilitated areas not only in the musculoskeletal system (including joints, muscles, fascia, and disks) but also the visceral organs and their connective tissues (including the liver, stomach, gallbladder, intestines and adrenal glands), the peripheral nervous system, the sympathetic nervous system and even the spinal cord and brain.<sup>6</sup>

### **4.3. Neural Manipulation**

Neural Manipulation (NM) was developed by French Osteopath, Alain Croibier, in collaboration with Jean-Pierre Barral. Comparative studies found neural manipulation beneficial for various disorders such as:

- Lower back pain and sciatica
- Headaches and migraines
- Carpal tunnel syndrome
- Joint pain
- Digestive disorders
- Post-operative scar tissue pain
- Swallowing dysfunctions
- Thoracic outlet syndrome

- Whiplash injuries
- Birth injuries
- Neuralgia and neuritis
- Tendinitis
- Sprains and traumatic lesions
- Concussion and traumatic brain injuries
- And more

Neural manipulation examines mechanical relationships between the cranium/spine hard frame to the dura and neural elements. It provides assessment and treatment approaches to address restrictions of the dural and neural components not commonly focused on with musculoskeletal symptoms. Neural manipulation identifies and releases local nerve restrictions while at the same time examines the effect these local fixations have on the rest of the body, and by accessing this relationship, resolves the more comprehensive (global) dysfunctional patterns.<sup>7</sup>

A nerve only functions correctly when it is able to move freely within its surrounding structures. Neural manipulation facilitates nerve conductivity and intraneural blood supply for local and systemic responsiveness.

The neural manipulation is involved in all body functions and without neural control certain visceral activity cannot be maintained. The stimulation of nerves is processed centrally and reported back to the body as feedback. This sequence of responses functions providing no interference (fixation) is present.

#### **4.4. Case Studies**

The Upledger Institute International (UII) conducted a pilot program on the effects of CST on post-concussion symptoms in 2014 and 2015 offering two intensive therapy programs to former football players with post-concussion symptoms. The study was published in 2017 in the journal *Medical Acupuncture*, “CranioSacral Therapy and Visceral Manipulation: A New Treatment Intervention for Concussion Recovery,” found that 10 sessions of specific CST, visceral manipulation and neural manipulation resulted in greater improvements in pain intensity, range of motion, memory, cognition, and sleep.

UII’s research program was conducted on 11 former football players diagnosed with PCS, excluding participants with acute head trauma, in order to specifically study the long-term effects of concussion. Participants were given a week of intensive therapy performed by a team of health care professionals. The treatment program consisted of



two sessions daily, each session two hours in duration for a one week period that included CST, visceral manipulation and neural manipulation.

Outcomes were measured before treatment, after treatment and three months post-treatment, and included the effects on cognitive tasks, quality of life, headaches, dizziness, pain, range of motion, balance and sleep, among others.

Statistically significant outcomes, according to the study's abstract, existed in measures of pain intensity, cognition, memory, sleep and range of motion.

Anecdotally, many of the participants in these studies reported rapid, dramatic results. In addition to improvements in pain and other physical complaints, many also reported positive changes in cognition and emotion.

Eric Williams, a former member of the Washington Redskins and Detroit Lions, also wrote a testimonial to the therapies' positive effects. "My mood, my emotions and body had such a drastic change, it's really hard to put into words. My chronic pain was drastically reduced and my range of motion on 99 percent of my body parts increased significantly," he wrote. "I can't explain what they did or how they did it. All I know is, I'd do it again in [a] heartbeat."<sup>8</sup>

I conducted a trial program at my clinic on patients with PCS. My treatment program consisted of a combination of weekly craniosacral therapy, visceral manipulation and neural manipulation. Treatment sessions were performed once a week, each session was 55 minutes in duration for a total of 8 sessions.

Table 1.0 below shows each patients' symptoms pre-treatment as well as post-treatment.

Table 1.0: Effect of Osteopathy Treatments on Patients with Post-Concussion Syndrome

Patient	Pre-Treatment Symptoms	Post-Treatment Symptoms
#1. Whiplash MVA years ago	Migraines, neck pain	Migraine disappeared half way through the treatment, felt very relaxed at end of treatment
#2. Concussion MVA 2 years ago	Headaches, pain throughout body, depression, anxiety sleep disturbance	Reduced pain throughout, increased ROM at cervical spine, felt more calm and relaxed
#3. Severe MVA over 50 years ago	Headaches, pain throughout body, depression, anxiety sleep disturbance	Able to breathe easier from both nostrils, throat tightness released, emotional release, extreme calmness after each treatment
#4. Concussion from severe high speed MVA 2018, rear end MVA 2016	Neck and back pain, headaches, difficulty concentrating, fatigue, sleep disturbances, stopped working for 2 months	Reduced pain, increased focus and attention span, returned to work after 6 weeks, able to exercise at gym now for more than 30 mins without fatigue
#5. Several head trauma accidents since early childhood	Headaches, vertigo for over 10 yrs, chronic neck, shoulder and jaw pain,	Vertigo disappeared, neck, shoulder and jaw pain reduced significantly
#6. Concussion from MVA 2013, MVA in 2014	Neck, shoulder and jaw pain, depression, anxiety, weight gain, headaches, dizziness, light sensitivity, vision impairment;	Reduced pain throughout, less headaches, feels sense of deep calmness and relaxation after each treatment
#7. Concussion from MVA 2019	Neck, shoulder and jaw pain, anxiety, headaches, dizziness, light sensitivity, vision impairment, unable to work or go out in public places due to anxiety	Returned to work after 2 months, able to go out in public places after third treatment with no anxiety, reduced headaches and pain
#8. Concussion from MVA 2020	Neck and shoulder pain, headaches, dizziness, difficulty concentrating	Reduced pain, headaches less frequent, dizziness reduced, improved ability to concentrate

#9. Concussion from MVA in 2015	Neck and shoulder pain with headaches frequently since MVA	Reduced pain, headaches less frequent
#10. Whiplash from fall years ago	Neck and shoulder tension, jaw restrictions, headaches, on stress leave from too much anxiety	Felt immediately better after first treatment, face and jaw tension released, returned to her normal self after third treatment with the ability to handle stress triggers without anxiety attack, neck and shoulder tension released, feels more calm and relaxed
#11. Whiplash in MVA as a child	Headaches, neck and shoulder pain, anxiety, depression	Emotional release, neck and shoulder pain decreased, felt more calm and relaxed
#12. Concussion from recreational hockey game 2018	Headaches, jaw pain, dizziness, painful neck, jaw and shoulders;	Reduced pain with less headaches
#13. Concussion from MVA 2013, MVA 2014	Neck and shoulder pain	Posture corrected after first treatment with reduced pain
#14. Concussion from MVA decades ago	Headaches, neck and shoulder pain since MVA	Increased energy, pain reduced significantly, increased cervical ROM
#15. Concussion from MVA 2020	Neck, shoulder pain, low back, hip pain, headaches, dizziness, nausea, difficulty concentrating, difficulty finding words, sleep disturbances, stopped working	Reduced pain, increased cervical ROM, increased attention span, able to view computer screen for longer, sleeping better, returned to work after 8 treatments
#16. Concussion from MVA decades ago	Anxiety, chronic headaches, jaw, neck and shoulder pain	Headaches relieved after each treatment, reduced pain
#17. Whiplash MVA 2019	Anxiety, headaches, neck, shoulder, low back pain,	Reduced pain, increased cervical ROM, reduced anxiety



#18. Concussion several yrs ago,	Headaches, neck, shoulder, low back pain, anxiety, depression,	Reduced pain, increased cervical ROM, reduced anxiety

## 5. Conclusion

The outcomes from UII's programs and my own case studies were inspiring and showed real promise for viable treatment options for traumatic brain injury, concussion, and the secondary compensatory dysfunctions that occur following traumatic brain injury.

Changes in the continuity of fascia, restrictions in mobility of cranial structures, sutural restrictions, extensive dural connections provide a mechanism whereby trauma can be communicated. The combination of craniosacral therapy, visceral manipulation and neural manipulation addresses these structures and dysfunction directly, providing a mechanism whereby correction of such strain patterns is possible, facilitating reduction in symptoms, a greater functional ease and enhanced quality of life.

According to a statement from the Concussion Alliance, "Craniosacral Therapy [is] ... one of the most effective treatments that we've found for persistent post-concussion symptoms."

Osteopathic treatments are an important tool in the evaluation and treatment of the structural, vascular and neurologic tissue changes in concussion and post-concussion syndrome that occur throughout the body, brain and spinal cord. It is not a substitute for traditional therapies and re-education; it is the piece that is missing.

## 6. References

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