Concussions
and
Mild Head Injury

"Post Concussion" Syndrome

Whiplash Injuries

NeuroSensory Centers of America™

Treat the Source

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Concussions and Mild Head Injuries
Deceleration Injuries

Definition of Concussion

A concussion is defined as an acute deceleration event causing temporary or permanent symptoms of nervous system dysfunction. A concussion does not always involve a loss of consciousness. The mechanism of injury determines the severity of symptoms. Post-injury symptoms may include disorientation, dizziness, nausea, imbalance, "blurred" or distorted vision, loss of coordination and concentration and/or amnesia.

Research in the field of concussion and deceleration related injury has revealed that not all post accident symptoms are related specifically to injury of the brain. NEC's research has identified and linked common symptoms, such as nausea, dizziness, loss of coordination, "short term" memory loss, inability to focus, visual related difficulties and altered emotional status to vestibular (inner ear balance organ) abnormalities following whiplash or minor head injuries.

NEC has redefined concussion into three categories of concussions: **vestibular concussions** (inner ear), **cerebral concussions** (brain), and/or a combination of both (inner ear and brain).

How do we recognize "Post Concussion Syndrome"

Many patients who develop "Post Concussion Syndrome" do not seek medical help for many months or years following the injury. Many patients are completely unaware of the connection between their symptoms and the injury and may be quite confused by the change in their quality of life. The patient with a pure inner ear abnormality from a deceleration event does not typically appear ill to their doctor, friends or family. Compensation from your visual and muscular system allows a person to maintain their balance and appear normal externally. Only when a person with "Post Concussion Syndrome" is challenged to maintain their balance with only their vestibular (inner ear) input does it become apparent that they are even having a problem Although not life threatening, these symptoms are life altering and lead to both social and work related difficulties.

Symptoms of "Post Concussion Syndrome"

Early	Late
Headache	Memory disturbances
Dizziness	Poor concentration
Confusion	Irritability
Tinnitus	Sleep disturbances
Nausea	Personality changes
Vomiting	Fatigue
Vision changes	Visual Disturbances

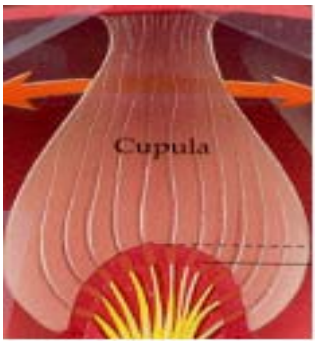
What causes the "Post Concussion Syndrome"?

Following a concussion, long-term secondary symptoms are commonly related to inaccurate information being sensed by the damaged or weakened vestibular sensor in the inner ear. This abnormality results in continuous misinformation being sent to the brain regarding the patient's position in 3-dimensional space. The secondary symptoms of the "post concussion" syndrome are caused by the brain attempting to adapt to the conflicting information the abnormal inner ear is providing. It is not uncommon for permanent damage to the balance system to result in long-term symptoms even after the first concussion. These symptoms are sometimes vague and most patients will appear "normal" at first impression. Commonly overlooked complaints include cognitive dysfunction, decrease in reflex speed, sleep pattern disruptions, fatigue, "short-term" memory loss, difficulty with concentration or "focus", anxiety, irritability, visual disturbances, panic attacks and even depression.

The **Reticular Activating System** is an area of the brain that acts as the "processor" for in-coming information of all types and is responsible for "awareness" or the feeling of being "awake" or "clear". Abnormal input from the inner ear confuses the brain by creating a "sensory" dilemma. This dilemma results in a reduction in the processing speed of the brain in an attempt to understand the conflicting information.

The **Limbic System** is a portion of the brain responsible for sensations of "feelings". Patients with post concussion abnormalities often describe sensations of hyper-emotionality, such as uncontrolled outbursts of crying, anxiety or anger. Additionally, patients frequently describe sensations of panic, and may have frank panic attacks. In these patients prescriptions for anti-depressants or benzodiazepenes (Valium, Xanax, Antivert) may be used to reduce symptoms. These symptoms will not resolve until the abnormal input is resolved. Some patients will resolve this spontaneously, while others require medical and therapeutic intervention. Once the balance system has returned to normal, the symptoms of "Post Concussion Syndrome" will improve.

Mechanism of a "Vestibular" Concussion or Deceleration Injury



Deceleration forces sheer the cupula in the direction of the injury causing temporary malfunction and minor hemorrhage in the inner ear. These forces lead to the early effects of concussion.

The hemorrhage eventually reaches the endolymphatic sac where it cannot be drained and must dissolve causing increased fluid in the inner ear (endolymphatic hydrops). This malfunction causes the late and continuous effects of concussion.

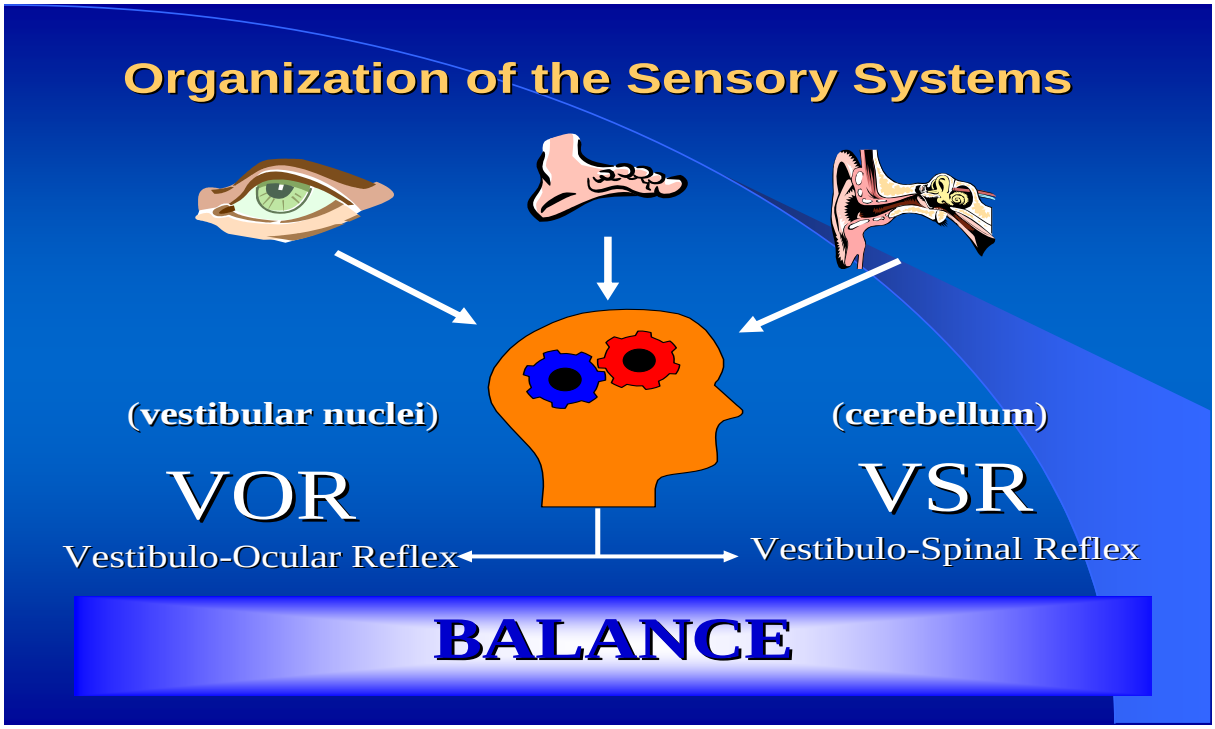
Diagnosis and Treatement

The body's ability to maintain balance during high-speed movement come from 2 primary reflexes: one that control our vision during high speed movement (VOR) and the other that maintains the position of our body in space (VSR).Following a concussion or mild head injury, many athletes have deficiencies in these reflex responses. Recent advances in diagnostic testing have allowed for extremely precise and accurate measurements of these important reflexes.

The ability to correctly diagnosis and treat which concussion based injuries are involved in a patient is essential to establish an appropriate care plan for the patient. Both vestibular and cerebral concussions can have the same type symptoms, which makes it hard to distinguish. In the past we have treated all concussions with conservative methods of rest and inactivity. We must understand that the treatment for each is significantly different, and periods of rest can actually slow the recovery from a vestibular (inner ear) concussion causing slower reflex speed, poor balance and muscular weakness. This factor alone can dramatically affect the patients' ability and safety to return to activity. NEC's methods will identify patients with inner ear abnormalities by assessing both the vestibular spinal reflex (VSR) for balance strategies and reflex speed and the vestibular ocular reflex (VOR) responsible for clarity of vision during movement.

Why test the inner ear?

The inner ear, just like other sensory organs providing in formation to the brain, is essentially a modified nerve. This fact is blessing in disguise because malfunction of the nervous system can be limited to very few causes. The causes of malfunction of the nervous system can include trauma, toxins, electrolyte abnormalities, hereditary malformation or infection. Because the inner ear provides two of the primary sensory systems that feed the brain information, balance and hearing, it is imperative to ensure that the inner ear has not been damaged during the head injury.



How do you treat "Post Concussion Syndrome"?

Initial treatment once you are diagnosed with "Post Concussion Syndrome" is to stabilize the inner ear and ensure that no direct brain injury has occurred. The immediate goal is to return to normal cognitive function so that academic, work and other daily activities are not affected. Additionally, treatment is aimed at improving reflex speed and balance in order to reduce the risk of subsequent injury. This initial phase of treatment involves safe, non-addictive medications typically used for up to 3 months. These medications can include curative agents and symptom relief medications. The symptoms medications may be withdrawn in 2-3 weeks, while the curative medications may be used longer. Once the inner ear is stabilized, customized physical therapy involving rapid head movements and balance modification exercise is used to speed recovery. Research has indicated that early medical intervention may speed the recovery time. Therefore, any subsequent mild head injury or concussion must be seen in a timely manner.

Evaluating the "Post Concussion" Patient

The diagnostic evaluation of the "post concussion" or mild head injury patient has two primary goals:

- Locating the source of the problem
- Assessing the severity of impairment and stability of function

The most important part of each evaluation is the history of the problem. A detailed description of symptoms is the key element used in directing the appropriate tests required for diagnosis of the problem. Important questions which will likely be asked include:

- How many concussions or whiplash injuries have you previously sustained?
- Did you lose consciousness following the concussion or whiplash? How long?
- Do you have spells or are your symptoms constant?
- Do you have hearing loss, ringing or fullness of the ears, headache or visual difficulties?
- Do you get worse with changes in position, weather changes, mental stress, exertion?
- Do you have difficulty maintaining your balance in the dark or on grass?
- Do you have "short-term" memory loss, sleep pattern disruptions or a lack of concentration?
- Have you had panic attacks or depression since the injury?
- Is there a family history of vertigo, imbalance or hearing loss?
- Have you suffered from any lower extremity or joint injuries in the past?
- Has your school or work performance worsened?
- Has your athletic or work ability worsened since the injury?
- Have you felt "sluggish" since the injury?

Each of these questions provides important information about the nature of your problem, severity of injury and treatment course needed for maximal recovery.

TESTING THE INNER EAR

Diagnostic testing of the inner ear involves a complicated and time intensive process. No one test is able to adequately diagnose your problem and NEC's methods use information from a variety of testing methods to verify and appropriately treat your problem. Many of these tests will be repeated on subsequent visits in order to assess the stability of the system, to verify improvement and to customize your treatment methodology.

Audiometric Evaluation (Hearing Test / Oto-Acoustic Emmissions)

The hearing and balance systems contained in the inner ear are intimately related and share many physiologic functions. A hearing test is the necessary starting point in the evaluation and treatment of all inner ear disorders. Specific hearing patterns are seen with most inner ear abnormalities and are essential to development of a treatment plan for the patient.

Computerized Dynamic Platform Posturography

The body relies on information from three systems to help maintain balance. These systems are the visual system (eyes), the somatosensory system (muscles and joints), and the vestibular system (inner ear). These systems work together to provide information to your brain about how to keep you upright and balanced as you engage in everyday activities. A "platform" test measures each of the above systems independently, as well as, how they function as a unit.

Vestibular-Ocular Reflex Test / Electronystagmography

At high rates of speed, the inner ear is responsible for coordinating eye movements in order to keep vision stable. Vision stability during movement is controlled through a reflex called the Vestibulo-Ocular Reflex (VOR). The VOR function test is basically an eye-head coordination test -- it measures the accuracy to which the eyes can remain focused on an object while the head is moving.

ImPACT Neuro-cognitive Testing

ImPACT is a computer driven, standardized method to quickly ascertain cognitive status, "short-term" memory, concentration and response speed. This test was developed for patient's following concussions and mild head injuries and is currently being used as the standard test of visual processing by the NFL. It has proven to be greatly useful in objectively verifying cognitive dysfunction and allows the physician to prove that patients are having trouble "thinking" and "focusing" and that our therapies for the inner ear have improved the situation.

Frequently Asked Questions

How long until my symptoms improve?

Many symptoms can improve as early as 2-3 days, however, resolution of all secondary symptoms is variable and may take up to 3-12 weeks to improve. Please remember that these symptoms fluctuate from day to day. During the curative phase of the treatment, some symptom medications are used for a short period of time. Each patient is treated individually according to his/her problem, and improvement may vary from patient to patient.

How often will I be expected to follow up with re-testing?

The doctor would like to see re-testing done every 6 weeks. This re-testing provides the healthcare team with specific information to customize your plan of care and accurately follow your progress. This method is unique and above all provides the most successful approach to evaluating and treating the inner ear problem.

Will my insurance cover the treatment?

Insurance is a contract between you and your insurance carrier. All of our testing is approved by Medicare and most insurance carriers. Platform posturography is not reimbursed by Medicare in the state of Texas, but is reimbursable in other states, and may be denied by other insurance carriers. It is essential for objective verification of improvement and modification of your care plan. No testing is performed without prior research indicating its necessity and efficacy.

How safe are the medications that are used?

The medications used in the NSC protocol have been studied extensively by NSC and the FDA. None of the medications contain any addictive potential of interact with other medications in a significant fashion. These medications are not banned by the IOC (International Olympic Committee) or the NCAA.

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NSC Research

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