

**Back To Chiropractic Continuing Education Seminars
History & Exam How To Use Concussion Tests ~ 4 Hours
Presented by Steven C Eggleston, DC, Esq.**

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This course counts toward your California Board of Chiropractic Examiners CE.

(also accepted in other states, check our website or with your Chiropractic State Board)

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Marcus Strutz, DC

Back To Chiropractic CE Seminars

History & Exam – Using Simple Concussion Tests – 4 Hours
Back To Chiropractic CE Seminars
Presented by Steven C Eggleston, DC, Esq.

Objectives

The objective of this course is to teach chiropractors how to use the most respected concussion questionnaires and tests. They will be taught to screen patients using the Acute Concussion Evaluation (ACE) from the Centers for Disease Control (USA), the Rivermead Concussion Questionnaire (Britain), the Epworth Sleep Questionnaire (Australia), the Folstein Mini-Mental State Examination (MMSE) and three follow up questionnaires developed for re-evaluations to quantify the progress (or lack) in their concussion patients. Patients are walking into chiropractic offices all the time with concussions from sports injuries and car accidents. The objective of this course is to help them recognize concussions, screen for them and make appropriate rules as required under Board Rule 317(w).

Hour 1

There is an in depth analysis of the Acute Concussion Evaluation, the Rivermead Concussion Questionnaire, the Epworth Sleep Questionnaire and the Folstein Mini-Mental State Examination. Examples of these questionnaire forms are supplied and doctors are taught how to use them.

Hour 2

Participants will be taught how to use the questionnaires, Assessment of Reactions to a Stressful Car Accident, Head Injury Follow Up Questionnaire, Rivermead Head Injury Service Follow Up Questionnaire and Head Injury Outcome Assessment. This is followed by a discussion of other concussion screening tests.

Hour 3

The physiology of concussions is presented including studies from the literature so doctors will be able to understand how this affects their own patients. Doctors will be taught the exact meanings of the test of shining a light into a patient's eyes.

Hour 4

Primary and secondary brain damage is discussed. Participants will learn 5 of the most common symptoms of brain concussion and how they can advise their patients in the process of rehabilitation of these brain functions. Finally, treatment options for concussions are discussed including hyperbaric oxygen therapy and biofeedback.

The secret to quickly examining a patient you suspect has a brain concussion is to use questionnaires developed by the leading brain injury treatment facilities in the world. I present here the Acute Concussion Evaluation (ACE) from the Centers for Disease Control (USA), the Rivermead Concussion Questionnaire (Britain), the Epworth Sleep Questionnaire (Australia), the Folstein Mini-Mental State Examination (MMSE) and three follow up questionnaires developed for re-evaluations to quantify the progress (or lack) in your concussion patients.

Each time you have a patient fill out one of these forms, you have created and placed in the patient's chart a full page of data that is respected by attorneys and claim adjusters alike. There are also billing codes to use for these questionnaires so the time you spend going over them with the patient is billed at your usual and customary hourly billing rate. You will typically use at least 4 of these screening questionnaires during the initial examination and bill each one for \$45 to \$150 dollars each by using the correct codes as I will present here. You will use one or two every month during your monthly reevaluations of the patient.

These questionnaires are to help you *screen* you patient for concussion. It is your responsibility to make appropriate referrals to neuropsychologists, psychiatrists, psychologists, neurologists and other specialists so the patient can get all the appropriate and necessary treatment to make the best possible recovery.

Screening Tests for Concussion (MTBI)

Brain tissue is very soft. It is composed of millions of very sensitive nerve cells that are easily injured. Shaking your brain can occur in two common ways: (1) Whiplash that whips your ten to fourteen pound head around at the end of your neck; or (2) striking your head on something that causes your brain to be shaken against the inside of your skull (contre-coup.)

Brain cells are stretched, torn, and bruised from the violent shaking. Electrical connections are broken. Electrical messages carried by your nerves do not get through to other parts of your brain or to your body. Neither your brain nor your body can function properly. Doctors have devised many tests over the years to test your brain's function to see if you have had a concussion.

You may remember seeing a football player lying on the field with the trainer shining a light in the eyes. They are testing the pupil reflex which is one of the most commonly used tests for brain concussion.

In addition, there are many other tests that have a consensus of acceptance in the medical community. Here is a brief explanation of these best questionnaires I have found or used.

Acute Concussion Evaluation (ACE)

One of the most modern systems to categorize and evaluate brain concussion symptoms is the Acute Concussion Evaluation (ACE.) This system uses four categories.

- Physical
- Cognitive
- Emotional
- Sleep

The ACE is a form I have used for my own patients and recommend to other doctors when I teach. The United States government likes it, too. The Acute Concussion Evaluation has been adopted and is being recommended by the Centers for Disease Control (CDC), National Institutes of Health (NIH), and Department of Health and Human Services. It has been codified into a form that is available for download from the government's website at www.cdc.gov.

You should be using this form to assess any brain concussion symptoms you may find in one of your patients after a car accident. The CDC has even published a booklet for doctors to learn about brain concussions. It is titled, *Heads Up: Facts for Physicians About Mild Traumatic Brain Injury*. You will find it easily by searching for the title on the CDC's website. Print the booklet and read it to get an even deeper understanding of brain concussion testing and diagnosis.

I have personally testified as a treating chiropractor in depositions about this test. When the attorney asks, "So, Dr. Eggleston, what the heck do you know about concussions? You're only a chiropractor." I respond, "It is not lowly chiropractor Eggleston that says this patient has a concussion. This ACE evaluation is from the Centers for Disease Control which is part of the cabinet level Department of Health and Human Services. So it is really the United States of America that says this patient has a concussion." That usually shuts off their snarky attitude and they become much more respectful during the rest of the deposition.

The CPT code for this evaluation is 90791 and chiropractors can bill and collect between \$45 and \$85 when you do it at the initial evaluation. If you bill more than one of these questionnaires (ACE, Rivermead, Epworth), use the CPT modifier 90791-51 for each subsequent one you bill after the first one on the same day.

Rivermead Post-Concussion Questionnaire

Another well respected form used to evaluate brain concussion patients is the Rivermead Post-Concussion Symptoms Questionnaire. Originally published in the *Journal of Neurology* in 1995, this form asks you how severely your concussion symptoms are affecting your life. It is, therefore, a measure of the severity of various concussion symptoms. Originally authored by Nigel S. King's group at Oxford University in the United Kingdom, this test has been cited in more than forty subsequent papers and carries significant respect in the medical community.

Often called the RPQ, the Rivermead Post-Concussion Questionnaire should be used repeatedly so long as your concussion symptoms continue. It gives the doctor data about the patient's concussion symptoms initially and should be used approximately once a month thereafter to evaluate your progress until the concussion is completely healed.

Information is very, very important to a doctor when dealing with brain injuries. They are the most complicated injury in the human body. I will explain how Rivermead assesses your symptoms so that you may be able to test yourself. You do not add up the

points of a Rivermead evaluation. You look at each symptom as an independent piece of information and the score as your personal assessment of its effect on you.

The Instructions for the Rivermead RPQ are as follows:

After a head injury or accident some people experience symptoms which can cause worry or nuisance. We would like to know if you now suffer any of the symptoms given below. As many of these symptoms occur normally, we would like you to *compare yourself now with before the accident*. For each one please circle the number closest to your answer.

Epworth Sleepiness Scale

This test is used to examine you for the Sleep Disruption symptoms of a brain concussion. It is a questionnaire intended to measure daytime dozing. It was introduced in 1991 by Dr. Murray Johns of [Epworth Hospital](#) in [Melbourne, Australia](#). It is a test that is well respected in the scientific community and a factor to be used in evaluating permanent sleep impairments under the AMA Guides to the Evaluation of Permanent Impairments.

The instructions are: How likely are you to doze off or fall asleep in the following situations, in contrast to feeling just tired? This refers to your usual way of life in recent times. Even if you have not done some of these things recently, try to work out how they would have affected you. Use the following scale to choose the most appropriate number for each situation:

- 0 = no chance of dozing
- 1 = slight chance of dozing
- 2 = moderate chance of dozing
- 3 = high chance of dozing

- _____ Sitting and reading
- _____ Watching TV
- _____ Sitting inactive in a public place (e.g. a theater or a meeting)
- _____ As a passenger in a car for an hour without a break
- _____ Lying down to rest in the afternoon when circumstances permit
- _____ Sitting and talking to someone
- _____ Sitting quietly after a lunch without alcohol
- _____ In a car, while stopped for a few minutes in traffic
- _____ Total points

You *do* add up the numbers when using the Epworth test (unlike the Rivermead RPQ.) A score greater than 10 is considered a Class II sleep impairment (10% to 29% whole person) in the AMA Guides to the Evaluation of Permanent Impairments, 5th Edition.

There are 24 possible points and it is normally reported by doctors in the following format: “11/24 on the Epworth Sleepiness Scale.”

Folstein Mini-Mental State Examination (MMSE)

This is a very important test to evaluate how well your patient’s brain is functioning after a concussion. Interestingly, it is the same test doctors use to examine patients with Alzheimer’s disease since the symptoms of Alzheimer’s and MTBI are very similar.

This test was originally published by Folstein, Folstein, and McHugh in the Journal of Psychiatric Research in 1975. It has been adopted and used widely as a test for dementia as well as brain concussions. Sometimes called the Mini Mental Status Examination, it is an objective measurement of the cognitive functions of the brain. I have seen neurologists use this test the same way you would say, “how is your neck?”

The doctor asks a series of questions that tests short-term memory, orientation to time and place, the brain’s ability to do simple math, whether the patient can remember three unrelated words, whether the patient can follow a series of three commands, whether the patient vision sees geometric shapes correctly and several other factors that are related to the higher thinking functions of your brain.

I strongly recommend this examination for brain concussion patients. It should be done routinely on all concussion patients. It should definitely be done at the beginning of care and can be used for follow-up examinations on a periodic basis. The Mini Mental Status Examination (MMSE) is a copyrighted form available for purchase at:

www.minimental.com

This is not a questionnaire that the patient fills out. It is an examination. You ask the questions and mark down the scores. You need to purchase the original examination from the copyright holder because it has all of the scoring data in the original exam. A “Normal” score on this test is different based on the patient’s level of education so you need to factor that into your opinion and results based on using the original materials you purchase from the copyright holder.

Since this is an examination, you do not use the 90791 CPT code to bill for it. You bill 96118 which for neuropsychological examination (not consultation). Billing for this code ranges between \$75 and \$150.

Assessment of Reactions to a Stressful Car Accident

This is a test used by the U.S. Veterans Administration to evaluate military cases of PTSD. The National Institutes of Mental Health states on its website, “Car accidents are a common cause of PTSD.” This form should be used initially to evaluate whether the patient has Post Traumatic Stress Disorder as well as a brain concussion. They frequently (but not always) are both present in the same patient.

I strongly recommend that you make an immediate referral when you find a patient that is suffering from PTSD. For more information about referrals and treatment protocols, you can take my online course titled “History & Exam – PTSD.” There are many types of specialists that treat PTSD so you will need to call around and meet some psychologists, psychiatrists and even clinical hypnotherapists who treat PTSD. As a personal note, I found astonishingly great results from clinical hypnotherapy for the PTSD I had after my accident. I also had quick and lasting success from EMDR therapy.

Head Injury Follow Up Questionnaire (HIF)

I developed and designed this form to be used during monthly reevaluations of patients. Notice that it has all of the common symptoms of concussion and PTSD but puts it into a format where the patient can tell you whether each individual symptoms is getting worse, staying the same, getting better, 100% well or if they never had that symptom.

This patient fills out the questionnaire and the doctor only has to look at it. A brief look will show the doctor quickly whether the patient is making improvement or is not really improving much. Notice at the bottom that the patient is given an opportunity to tell the doctor if he/she would like a referral to a specialist for either mental/emotional issues or for physical pain issues.

You should pay attention and make a referral when the patient asks you for a referral. Consider it a cry for help. Most patients do not like to admit how much they are struggling as a result of concussions and/or physical injuries so when they mark “Yes” on this form, you need to take it seriously.

Use this form monthly when you do your re-evaluations on patients who have concussions and/or PTSD to go along with their physical injuries. The CPT code is 90791 for this form.

Rivermead Head Injury Service Follow Up Questionnaire (RHFUQ)

This was published in the Journal of Neurology, Neurosurgery and Psychiatry in 1996, the year after the original Rivermead Questionnaire was published. It was designed as an outcome assessment tool for clinicians. I suggest using it every three months to assess the patient’s perspective of how intrusive the concussion symptoms are on his/her life. The CPT code for this questionnaire is 90791 and if you do more than one the same day, use the modifier -51 for billing the second, third or fourth questionnaire.

Head Injury Outcome Assessment (HIO)

I designed this form to be used every three months in conjunction with the RHFUQ. It has more symptoms and gives the doctor more information about the patient’s concussion symptoms and recovery. Notice that this questionnaire allows the patient to answer the question, “Would you like a referral to a specialist for help with your life?” A yes answer to this question is also a cry for help. It means they are perceiving their life to be a real mess and they are struggling just to cope with life.

This form tends to quantify and qualify a large number of the patient's concussion symptoms. The CPT code for this questionnaire is 90791. If you have the patient fill out more than one concussion questionnaire on the same day, bill the second, third, fourth etc. as 90791-51 to indicate that you know you are billing the same code more than once. Bill the code for each questionnaire you review that the patient has filled out that day.

Other Concussion Tests

There are many, many tests for brain concussions. These that I have presented are some of the most respected *screening* tests. Screening tests are those routinely done by doctors that determine whether additional (more expensive) tests need to be done. All of these tests should be routinely used by general practitioners (GP) such as family M.D.s and chiropractors at the intervals I described in this course.

It is the duty of GPs to evaluate *all* of the patient's symptoms. These questionnaires allow general practitioners like chiropractors to determine whether to send you to a neuropsychologist. They are also used to monitor the patient's progress (or lack thereof.) It is reasonable in very mild concussions to not make an immediate referral to a neuropsychologist and, in that case, you may monitor you for a month once the concussion diagnosis has been made. However, if concussion/MTBI symptoms persist longer than thirty days, you need to reevaluate your patient and make a referral. Concussions and PTSD are life-changing devastating injuries in many cases and you need to uphold the trust your patient placed in you by asking you to be his/her doctor. Make a referral to a neuropsychologist immediately for more detailed tests and evaluations.

You can also use the information in these questionnaires to decide if or when to order tests like QEEG (Quantitative Electroencephalogram), CT (Computerized Axial Tomography), MRI (Magnetic Resonance Imaging), SPECT (Single Photon Emission Computerized Tomography), PET (Positron Emission Tomography), Lumbar puncture, Angiogram, EEG (Electroencephalogram) and other tests. These are tests that chiropractors in the 21st century need to be familiar with and know people that do them so referrals can be made for your patients. It is below the standard of care and violates Board Rule 317(w) to fail to do a history and/or exam that does not include concussion and PTSD symptoms given that fact that our profession sees so many car accident patients and sports injury patients.

Don't be confused when a brain CT or brain MRI is "negative." It definitely does not mean you do not have a concussion. It means there is no bleeding into your brain and that you are not going to die suddenly (like the actress Natasha Richardson) after a relatively mild head trauma. MRI and CT are not good tests for assessing concussion/MTBI. They are used to make sure it is not something worse that could kill the patient like subdural hematoma or some other bleeding into the brain.

I suggest that general practice doctors screen for both MTBI and PTSD for any patient that has been in a car accident. I further suggest that doctors follow up for two to four months with MTBI and PTSD screening because both of these conditions are known to develop slowly over time and get worse for weeks and even months after a car accident.

The full testing procedure for brain concussion is complete neurological examination. It is usually five to eight hours long and costs thousands of dollars. It is the most respected test in California courtrooms so expect this test to be done if you have concussion symptoms for many months.

Brain Concussion: Shaken Adult Syndrome

What exactly is a concussion? The word derives from the Latin *concutere*, which means “to shake violently.” Most of us understand Shaken Baby Syndrome which is a close cousin to adult brain concussions. Babies get concussions from an adult shaking them. Imagine that the Jolly Green Giant grabbed you and shook you (like an adult shakes a baby.) You could get a concussion because something much larger, heavier, and stronger than you is shaking you violently.

Adults get concussions from having their heads shaken when a big, heavy automobile or truck crashes into their car at 10 or 15 miles per hour (mph.) A collision at 15 mph causes very little damage to your car. With car rear bumpers being made very, very strong these days, it generally takes an impact from a car moving more than 10 mph to cause even a little visible damage.

However, the impact of a car moving less than 10 mph that causes NO visible damage to the car has been shown scientifically to produce G-forces of 10g to as much as 14g on the driver’s head and neck. Despite this, the auto insurers persist in their dogmatic (money making) approach that you cannot be injured unless there is at least \$2,000 damage to your car. It is unscientific (but profitable.) As I have often repeated, they can fool some of the jurors all the time and all of the jurors some of the time.

Remember the example I described earlier that your head is as heavy as a bowling ball? If a 4,000 pound car were to hit a twelve pound bowling ball at 15 mph, the bowling ball would fly and roll a long, long way down the street. When your car is hit by a 4,000 pound car and your twelve pound head is shaken violently during a whiplash, your brain can be concussed from the violent shaking of your head. I call this Shaken Adult Syndrome.

Car accidents shake your head violently for about 300 milliseconds. There is violent shaking for a short period of time. Sudden, quick, severe force will injure you more than slow, deliberate, mild force. Imagine you are driving your car at 15 mph and the light turns red. You apply the brakes and slow down to a complete stop. You went from 15 mph to zero mph and were not injured. Now imagine you are driving 15 mph and run into a concrete wall twenty feet thick. In both examples you went from 15 miles per hour to zero. The difference is how long it took to stop. The shorter the time period of deceleration, the more likely you are to be injured.

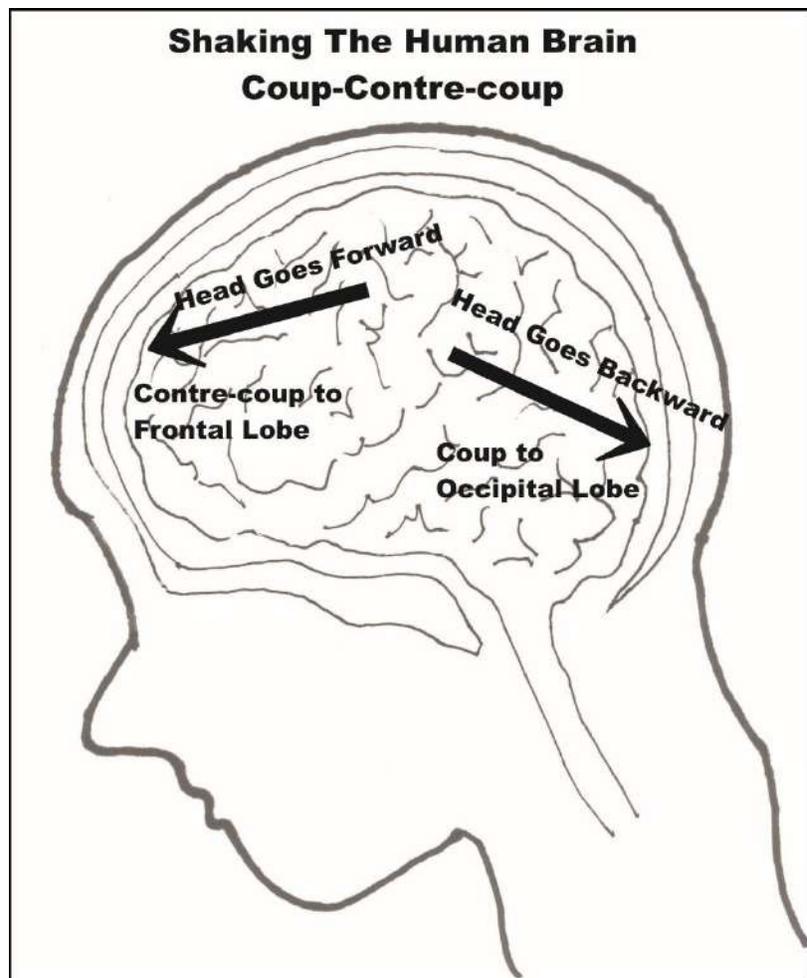
Gradually turning your head to look into the rear view mirror will not cause a brain concussion. Having your head shaken at 15g force by a 10 mph rear end accident can definitely cause Shaken Adult Syndrome (commonly known as brain concussion.) Will it

always cause brain concussion? No. How will you know if you have a concussion? Only your doctor can tell.

There are many tests your doctor may use to determine whether you have a concussion. Since not all accidents cause brain concussions, your doctor is the person with education and experience in diagnosing concussions. For now, I just want you to understand that when your head is shaken with sufficient G-forces, your brain strikes violently against the inside of your skull. The long nerve cells in your brain can stretch, twist and break as your brain is shaken.

Shaking Causes Concussions-NOT Hitting Your Head

There is no bigger myth in the auto insurance industry than the mistaken belief that you have to hit your head on something to get a concussion. Since the word “concussion” means to “shake”, people who believe this myth simply do not understand simple medical terms. Shaking your head causes a concussion. When you hear about someone getting a concussion after hitting their head, you should understand that *hitting the head caused the brain to shake*. Shaking the brain is what causes the concussion.



Doctors understand this mechanism so well that it has a name. Scientists call it *contre-coup* (from the Latin meaning opposite blow.) The English version of *contre-coup* is

countercoup and they are used interchangeably. You hit the right side of your head and it shakes your brain so that the left side of your brain hits the left side of the inside of your skull. The left side of the brain is injured in this contre-coup type brain concussion. The reality is that many different areas of the brain's nerves can be injured when your head shakes violently during a whiplash.

In a rear-end auto accident, the head goes backward (until it stops and switches directions.) Once the skull stops and switches directions, the soft, mushy brain keeps going and hits the back of the inside of the hard skull. Then the head goes forward and, when it stops, the soft, mushy brain keeps going and hits the inside of the front of the hard skull. Coup means to strike (the inside of the skull) and Contre means the opposite side (as is contralateral.)

Thus, this very well-known medical fact of Coup and Contre-coup brain injury absolutely does not need anything to hit the outside of the skull in order to strike both sides of the brain on the inside of the skull. Violent shaking is all it takes. Period.

A team of German scientists more than fifty years ago proved that monkeys were more likely to have a concussion after shaking their heads than after hitting their heads. The National Institutes of Health and Centers for Disease Control (U.S. Government) have published the Acute Concussion Evaluation. It makes it very clear that concussions are caused by both direct blows and *indirect* blows to the brain (shaking.)

Let me say this clearly. It is complete and utter nonsense that you must hit your head on something to get a concussion. Doctors who believe it must have been asleep in neurology class during medical or chiropractic school. Insurance adjusters who believe it are simply uneducated and believe what their employers have told them. If you are ever on a jury and hear the insurance company doctor tell this myth, you should not believe it (or any of the other things he says either since he is obviously not telling the truth about this one thing.)

No less than the Director of Neuropsychiatry at Dartmouth Medical School wrote in 2011 that there are two mechanisms of injury in brain concussion: (1) Contact forces; and (2) inertial forces. He wrote, "Contact injuries result when the brain, moving inside the skull, strikes the inner surface of the skull. Movement of brain against the various ridges and bony protuberances of the anterior (frontal) and middle (temporal) fossae is particularly injurious to the temporal and frontal poles and the ventral anterior, medial and lateral temporal cortices, and the frontal cortices."

Notice that this Ivy League doctor states unequivocally that the brain is injured by movement of the brain (shaking) striking the inside of the skull (contre-coup). One would think this research would be taught to claim adjusters at the insurance companies.

I will share one funny and bizarre conversation I had with a claim adjuster. He claimed my client couldn't have a concussion because she didn't hit her head on anything. I knew that explaining the scientific "shake" theory would be way above his level of intelligence and education, so I tried to talk to him on his level. I simply told him that this was a rear

end accident and my client's head hit the headrest. He said, "It doesn't say that in the medical records." I replied, "It doesn't have to. It is so obvious that no doctor would waste time and ink to write down something as obvious as that the sky is blue." He said, "It doesn't say it in the medical records." Exasperated, I finally said, "Do you understand that if you fall out of a boat floating on a lake you will hit the water?" He said, "Yes, that's obvious." I said, "It is just as obvious that if you get hit from behind, your head will go back and hit the head rest." He didn't miss a beat and said, "But it doesn't say she hit her head in the medical records so we're not going to pay for a concussion."

The doctor had done many of the tests I described in Chapter 10 and had written down a diagnosis of concussion in his records several times. However, that was not good enough for this mental midget of a claim adjuster. I really could not tell whether this claim adjuster was really that dumb or he was just repeating the mantra that he had been taught to say by the insurance company. The arrogance of the ignorant is never more obvious than with some insurance claim adjusters.

Is There A Brain Concussion Threshold?

How much force does it take to cause a brain concussion? The insurance companies would like to have a formula that equates it to dollars of damage to the bumper of your car. That, of course, is medically ridiculous and scientifically absurd.

I recommend we leave the diagnosing of brain concussions to knowledgeable, trained, educated people like doctors. These people have studied anatomy, biology, physiology, and have dissected a human brain in college. Claim adjusters are not educated enough to diagnose a brain concussion. What they are actually doing in those cases is *diagnosing the absence of a brain concussion* (so their employer will not have to pay the claim.) Claim adjusters are not doctors. They confidently proclaim your doctor is wrong. The best description of this is *arrogant ignorance*.

The World Health Organization, The American Congress of Rehabilitative Medicine, and the American Psychiatric Association all have different definitions of concussion. When the most intelligent and educated people in the world cannot agree on a threshold for concussion injury, I am astonished at the arrogance of insurance claim adjusters who think they can diagnose this injury (or lack thereof) simply by saying the patient didn't hit his head on anything or because there wasn't much damage to your car.

Doctors are licensed by the state in which they practice to *diagnose*. Diagnosing any disease or injury without having passed your state's medical or chiropractic board examination is practicing medicine without a license (a crime in many states.) The truth is that nobody is licensed to *diagnose* a brain concussion other than a board certified doctor. A claim adjuster who diagnoses the absence of a concussion is practicing medicine without a license in my opinion. I would like to see the medical boards in the various states start enforcing this statute and prosecute claim adjusters that are diagnosing without a license. You, the treating chiropractor, must "make the call" when a concussion exists. Diagnose it based on the patient's symptoms. It is not your job to

explain the biomechanics of the forces. You just focus on the patient's injuries and symptoms and do YOUR job. Let us lawyers do the rest.

Looking Into Your Eyes

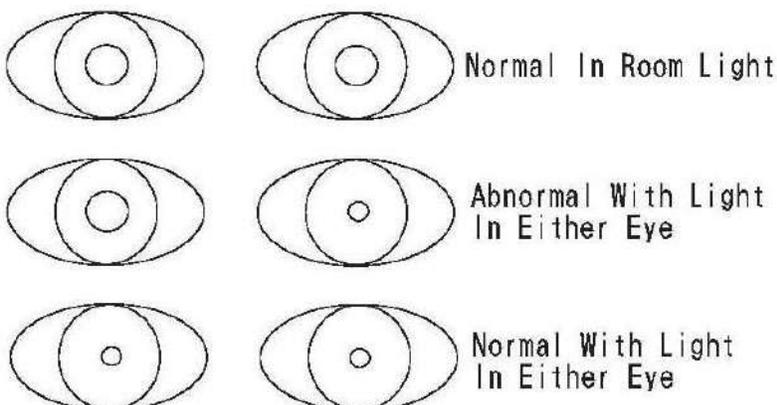
One of the oldest tests for acute brain concussion is checking the pupil reflex. The doctor shines a flashlight into the eyes and observes the speed that the pupil constricts as well as whether the pupils constrict equally. If one pupil is noticeably slower than the other or fails to get as small as the other, this can indicate a brain concussion and a lot of other things. This old method of shining light into the patient's eyes has been plagued by subjectivity of the examiner as well as non-reproducibility among different examiners.

The pupil reflex is tested by first asking the patient to stare at an object far away, then shining a bright light slightly upward into the patient's pupil (not straight into the eye.) The Direct Reflex tests the pupil into which the light is directed. That pupil should constrict briskly after a latency period of 200 to 500 milliseconds. The opposite pupil (Consensual Reflex) should also constrict at the same time and almost as much as the pupil receiving the light.

As the patient continues to stare at a distant object, the light is then directed into the opposite eye and then that eye's Direct Reflex is tested and the first tested eye's Consensual Reflex is being tested.

Finally, the pupils are tested for Accommodation Reflex. Pupils get smaller when focusing on near objects and larger when focusing on far objects. The patient is asked to stare at a distant object (the other side of the room is far enough) while the examiner observes the size of the pupils. The patient is then asked to focus on a close object (such as the examiner's finger directly in front of the face) while the examiner observes both pupils. Normal reaction is that both pupils get smaller when focusing on the near object.

We now know that the size of the pupils is constantly changing. When the pupils rhythmically oscillate (especially in bright light), this is actually a normal response called hippus. Another normal condition is called pupillary escape.



The pupil constricts the most immediately after the bright light enters either eye but then the eye relaxes a little even if the bright light continues to enter the eye. The amount of pupillary escape is highly variable. What the examiner should see in a normal patient is initial brisk and complete constriction of both pupils at once. If the light is held on the eye more than a second or two, pupillary escape occurs followed by hippus. The examiner may need to shine the light twice briefly into each eye while the examiner's observes first the Direct Reflex and then the Consensual Reflex.

Primary (direct) and Secondary (indirect) brain damage can occur from shaking the brain. Once you understand these, you will be on your way to understanding why some of these had to be caused by shaking and could not even be caused by just hitting your head.

Primary Brain Damage from Concussions

1. **Alterations in blood flow to the brain.** This causes oxygen deprivation to the brain just like a stroke causes damage by depriving the brain of precious oxygen.
2. **Widespread injury to the axons.** This means stretching and tearing of brain cells. Since these brain cells are like little wires that carry electrical messages, stretching and tearing them causes short-circuits all over the brain. Stretching and tearing are caused by shaking, not hitting your head. It is virtually impossible to stretch or tear an axon by hitting your head.
3. **Specific lesions (damaged areas) of the brain.** Some of these damaged areas are visible on MRI films (but most are not.)
4. **Vestibular damage.** The vestibular system controls balance and equilibrium in your body. Injury to these nerves and structures causes dizziness, vertigo, and bumping into things like walls and furniture.
5. **Slowed information processing.** With your brain short-circuiting on a widespread basis, messages that are sent from one area of the brain to another area simply never get where they are going. This causes slowed thinking, difficulty concentrating and a foggy-head feeling. Your brain keeps trying to get a message from point A to point B and may send it via different pathways until it finds one that is still functioning properly. It slows down the processing of that thought and, essentially, takes longer to think. It is similar to an accident on the freeway on your way to work. You can take a detour but it will take a lot longer to get to work.

Secondary Brain Damage from Concussions

1. **Neurotransmitter dysfunction.** Your brain cells connect to other brain cells by a system of chemicals that can transmit the message from one cell to the next, just like a wire that is spliced to another wire. "Neuro" means nerve. "Transmitter" means the chemical splice that allows the message to move from nerve cell to the next nerve cell. "Dysfunction" means altered or abnormal function. This means that messages cannot jump from one nerve to the next so the message never gets to where it was going. When your brain's chemicals are

- messed up by the shaking of your brain, you can have long-term effects of slowing down your brain's ability to think and function.
2. **Brain swelling.** Once your brain starts to swell, there is nowhere for it to go except to press against the hard bones of the inside of your skull. This pressure is like setting a ten pound sack of flour on your arm and letting it sit there for weeks or months. It doesn't bother you much at first, but the longer the pressure is there, the more uncomfortable your arm becomes. Likewise, swelling inside your skull puts pressure on delicate brain tissue and damages the nerves. Pressure on nerves causes them to not function properly as long as the pressure exists. Long term pressure can cause the nerve cell to die and make the dysfunction permanent. This is so critical that doctors will even drill holes in a patient's skull to relieve intracranial pressure.
 3. **Degeneration and dying brain cells.** You really do not want your brain cells to die. The more brain cells that die, the less thinking your brain can do. Early diagnosis of a brain concussion with proper treatment can minimize the number of brain cells that die after your car accident.
 4. **Use of glucose by the brain is decreased.** Since glucose is the energy fuel for your brain cells, when the concussion slows down the brain's ability to absorb and use glucose, your brain cells have no energy. You may experience excessive fatigue and your sleep patterns are affected. Since lack of sleep also causes many other illnesses like heart disease, any interference with your sleep can have long and lasting negative health consequences.
 5. **Lung and oxygen dysfunction.** When your lungs no longer fully exchange oxygen because of the concussion, your whole body can be deprived of oxygen. When your muscles run out of oxygen, you feel a burning pain in them. In addition to the physical injuries to your body, a concussion may deprive all of your muscles of oxygen and cause even more muscles to ache, not just the ones that are injured. Imagine the effects if your whole body is deprived of oxygen because of this secondary effect of your concussion. You will heal much slower, your organs will not function well, and your entire physiology slows down. Scientific studies have shown that patients with brain concussions feel pain differently than patients with similar physical injuries (but no concussion.) I believe that many patients diagnosed with fibromyalgia and even Alzheimer's disease may have had undiagnosed concussions earlier in life. A study published in the Journal of Neurosurgery in 2005 concluded, "Our findings suggest that the onset of dementia-related syndromes may be initiated by repetitive cerebral concussions in professional football players."

These primary and secondary types of brain damage can take weeks or months to fully develop. They often last many years and your accident can turn into a true health nightmare. As I stated earlier, do not be too quick to settle your claim and deprive yourself of the accurate and proper picture of your injuries at settlement time.

Since medical studies such as the one above suggest that Alzheimer's disease and other dementia type memory problems may be caused by concussions earlier in life, make sure your doctors accurately diagnose you after a car accident. It is a tragedy when doctors miss a concussion. The patient gets a paltry settlement of a few thousand dollars and may

end up with fibromyalgia or Alzheimer's disease ten or twenty years later. In that situation, the patient was definitely NOT compensated adequately for the injuries from that accident!

Some Common Symptoms of Brain Concussion

1. **Memory.** Your memory is the ability to learn new things, recall things you heard or saw, recognize things and people, and memorize things. When a concussion affects your memory, you may have difficulty with *short-term* memory while you can easily remember things you did thirty years ago that are in your long term memory. Since dreaming is now believed to be an important method your brain uses to transfer short-term memories into long-term memories *and* concussions interfere with your sleep, I am of the opinion that the sleep disruption from a concussion may be part of the reason you are also having short-term memory loss. You are not dreaming because you cannot get into the deeper sleep cycles because of your concussion. No dreams means that your memories from that day are not transferred into your long term memory and the next day you forgot what you did the day before. I believe this is an area that needs more research.
2. **Executive Functioning.** Think of an executive who must plan, organize, and make decisions. These are the executive functions of the front part of the brain. The frontal lobe of your brain is shaken in some concussions and nerves in this area are sheared and broken. When this area of your brain is concussed, you may not be able to plan the activities you have done for years. You will think and think and think and not be able to make a decision about what to do. You may have been the greatest organizer before the concussion and not be able to organize yourself after the accident.
3. **Attention.** After a concussion, it is not that you cannot pay attention at all. You just have difficulty paying attention *for any length of time* or paying attention to the right things. You have to force yourself to focus so much it makes you tired from just thinking. Biofeedback helped me the most to recover my normal attention span.
4. **Language and Communication.** This affects your brain's ability to interpret words you hear, words you see with your eyes, and your ability to speak the words you have known and used all your life. You may find yourself re-reading things to understand them, asking people to repeat things, and stumbling to find the words you want to say out loud.
5. **Sensory and Motor Functions.** Think of a three-year-old child. You toss him a ball and he struggles to catch it. This is because three-year-olds have not yet developed the sensory and motor functions in their brains. It is a very complicated process to do several things at once. They must visually sense where the ball is in the space in front of them, compute quickly the speed it is traveling, and decide where to put their hands so that the ball and their hands arrive in the same space at the same time. This must all occur in a fraction of a second. These are the Sensory and Motor functions for spatial relationships that your brain developed as a child. A concussion damages your ability to do this type of coordination-requiring activity. Shaken Adult Syndrome can make

you essentially like a child again. It may take practice to bounce a ball and catch it after an accident.

This is not a complete list of brain concussion symptoms. I have explained them here to give you a brief idea how primary and secondary brain damage can affect some of the cognitive functions of the brain. See my other online course titled, “Diagnosing Concussion” for a more list of brain concussion symptoms. Now I will give you a brief example of how you can help your patients recover from these five concussion symptoms and rehabilitate their brains to function better again.

How to Rehabilitate Your Brain Functions

1. **Memory.** First, you must get help from your doctors to normalize your sleep patterns again. As long as you sleep too little, sleep too much, toss and turn all night, cannot fall asleep, and wake up in the middle of the night you will not be able to regain your failing memory. Second, you must exercise your memory. This is difficult since you also are feeling apathetic about life and do not feel like trying. You must force yourself to listen to music, avoid watching TV, do crossword puzzles, play card games, put together jig saw puzzles, read simple books (like comic books), and speak out loud as much as possible. Let me repeat. Listening to music is good for you. Watching TV is bad for you. Exercising your mind is good for you. Apathy and doing nothing is bad for your recovery. It is common for concussion patients to stop socializing with friends. You are consciously or subconsciously trying to hide your disability from these people who love you. Third, you must explain to your friends and family the symptoms you are having. They will feel tremendous relief knowing why you have been acting so strangely. Fourth, force yourself to do these memory-exercising activities whether alone or with friends and family. If you have children, they will not judge you but, rather, will enjoy the many hours you will spend with them playing games that were designed for youngsters. Playing with children will help your memory. Go to the toy store and purchase jigsaw puzzles and other games that are labeled “for ages 3 to 10.” These will help your brain to recover and your children will enjoy your company.
2. **Executive Functioning.** Stop trying to hide this from your friends and family. Trust me when I tell you that you are not fooling them. Suddenly you cannot make a decision, plan a vacation, or organize a calendar of events. My advice is to discuss this with those around you and delegate these responsibilities to others for several months (or longer) until you begin to regain these abilities. Keep in mind that you may not be performing up to your normal abilities at work. You will have to make a decision (difficult, I know) whether to tell your boss or not. If you do not tell your employer, be prepared that they may notice your poor performance and you may lose your job. If you do tell your employer, you may lose your job immediately. In the best case scenario, your employer can make an accommodation for your (hopefully) short-term mental disability from the concussion until you regain your abilities.

3. **Attention.** You may not be able to pay attention for more than a few minutes after a concussion. Use this time to find new things you are interested in. You will be surprised to find out that although you no longer care about gardening, you may find interest in new hobbies. Your brain needs extra stimulation in order to pay attention. Playing video games like Wii or xBox stimulates your brain with sights and sounds as well as helps with spatial relationships by using the paddles the game offers. I used Luminosity, the online brain training system, during my recovery and believe it helped me to pay attention for longer periods of time. I played it on my smart phone.
4. **Language and Communication.** Hearing, seeing, and speaking can all be affected by a brain concussion. Video games help with these because of the sounds of the game coupled with the images on the TV. Remember when you were in elementary school? The teacher made you read out loud? Now you know why (since you cannot understand what you read anymore.) I suggest that you get books on the grade level you understand and read them out loud. If you have small children, they will very much enjoy when you read them bedtime stories. Comic books are written on about the 8th grade level which makes them perfect for a concussion victim's level of comprehension. Read comic books out loud. Have a dictionary handy to look up words you don't understand. Stop worrying and start exercising your brain. You learned this once in elementary school. You can do it again.
5. **Sensory and Motor Functions.** As mentioned before, the Wii game and the xBox are some of the best ways of re-training your brain. You must perform the same activities you did between the ages of three and ten. This is the period of your life when you developed your sensory and motor functions because it is when you learned to throw and catch a ball, color inside the lines of your coloring book, etc. I suggest that you perform these simple tasks again because they will help your brain to re-connect the broken lines of communication between different areas of your brain that were affected by your head being shaken. You should bounce a ball and catch it. Eventually, you should be able to throw the ball against the wall and catch it. Play catch with someone. Try to hit a ball with a baseball bat or tennis racket. Kick a ball against the wall over and over. Use an Etch-A-Sketch. Put together jigsaw puzzles (start with ones with less than 100 pieces.) Add and subtract. Get a coloring book and Crayons and color the entire book. You lost the ability to perform the skills you learned in elementary school so you must go back and re-train your brain with elementary school activities. Start now. If you don't, you may be functioning at the 4th grade level for a long time.

Treatment Options for Concussions and PTSD Patients

With all the overlapping in concussion and PTSD symptoms as you will read later, I find that many or even most patients have symptoms of both concussion and PTSD after car accidents. There are treatments known to help patients with concussion symptoms as well as PTSD symptoms.

Hyperbaric Oxygen Therapy

Hyperbaric Oxygen Therapy (HBOT) is simply a treatment method to pressurize a hyperbaric chamber with a patient inside who breathes oxygen through a mask instead of plain air. The Food and Drug Administration (FDA) has approved HBOT to treat seventeen diseases or injuries for which it has been proven to be beneficial. The FDA's job is to protect Americans from unsafe food and unproven drugs (hence the name.) The FDA often approves a drug for treatment of one condition and then doctors prescribe that drug for other conditions that it also helps even though those other uses are not officially endorsed by the FDA. This is called prescribing a drug "off-label."

There is currently conflicting research on the efficacy of HBOT for treating brain concussions. It is widely believed to be effective but the FDA has not officially approved it for that purpose. One study published in early 2014 concluded that it is not effective in treating post-concussion syndrome that is more than one year after the concussion occurred. That study seemed to imply or suggest that it is effective for the first year after a concussion. Another study published in November, 2013, was titled, "Hyperbaric Oxygen Therapy Can Improve Post-Concussion Syndrome Years after Mild Traumatic Brain Injury – Randomized Prospective Trial."

The 2013 study concluded, "HBOT can induce neuroplasticity leading to repair of chronically impaired brain functions and improved quality of life in MTBI patients with prolonged post-concussion syndrome at late chronic stage." The patients in this study were between one year and five years post-injury. Notice that it does not conclude that it "absolutely and every time" cures post-concussion syndrome (essentially the FDA standard.) Its results were that, "Significant improvements were demonstrated in cognitive function and quality of life in both groups following HBOT (forty treatments) but no significant improvement was observed following the control period. SPECT imaging revealed elevated brain activity in good agreement with the cognitive improvements."

That sounds like HBOT is fairly effective. Treatments usually last an hour. The patient is placed in a hyperbaric chamber up to about 7 PSI or 1.5 atmospheres of pressure and breathes enriched oxygen (usually 90% to 100%) for an hour while under pressure.

My own personal experience after my accident is that I had noticeable improvement in my concussion symptoms after the tenth treatment. I had eighty treatments over the first year after my accident and then had a follow up SPECT brain scan which showed improved circulation and brain activity in my frontal lobes and virtually everywhere else in my brain except the left temporal lobe. The results of my SPECT scan corresponded astonishingly closely to my subjective symptoms. As the SPECT scan showed, the majority of my ongoing post-concussion symptoms were brain functions from the left temporal lobe. I believe strongly that HBOT helped me recover as quickly as possible from my concussion. My recovery was four times faster than my sister with a similar concussion and who never used HBOT.

Biofeedback Treatment for Concussions

The current gold standard testing and treatment for brain concussion is done by neuropsychologists. In California where I practice, the best evidence to document a brain concussion in court is neuropsychological testing. There are other types of doctors that certainly know enough to diagnose and even treat mild concussions but the doctor I recommend for evaluation and treatment of a concussion is a neuropsychologist.

I ended up finding a great neuropsychologist about a year and a half after my accident. I still had quite a lot of cognitive and memory problems. I could think, focus and concentrate but only for a few hours at a time. I could not do a full eight hours of work until I found my neuropsychologist. She looked at my original SPECT scan results, my follow up SPECT scan results and my medical history for the eighteen months since the accident. Then she told me, “Steve, without biofeedback you are as good as you are going to get as far as your memory and cognitive thinking.”

I first found a psychologist that advertised biofeedback. I went to her for six sessions and was not impressed. She hooked me up with two to four sensors each time and I had a terrible headache for two days after the first session. I told her that and she explained that there is a little bit of guesswork in the placement of electrodes and the tuning of the frequencies before each patient’s ideal treatment plan is found.

I was in the middle of these biofeedback sessions with a psychologist when I attended a lecture by a neuropsychologist. She explained that she performs a test called Quantative Electroencephalography (QEEG) before doing any biofeedback in order to determine the exact functioning and frequencies of the brain so her treatments can be effective right from the start. QEEG is a highly sensitive and relatively new test for evaluating brain concussion and PTSD patients. She put a cap on my head with about fifteen or twenty electrodes and put so much gel in my hair that she offered me a towel after the test to clean it off. The QEEG test was messy but effective.

She sat down with me and showed me an extensive printout of test results and explained which brain frequencies she needed to treat in order to help me. I told her about my prior six sessions with the other psychologist and she said, “I used to use that kind, too, ten years ago when it was all we had. We have better methods now.” I canceled my treatment plan with the psychologist that was using the older technique and began a series of twenty-six treatments using the LORETA method which is the kind that uses the cap with built in electrodes. I went two days a week and completed twenty treatments (the standard number) in about a month and a half. I felt immensely better and noticed that I had worked for nine or ten hours at a time several times toward the end of the twenty treatments. I did six more sessions about once a week.

I recommend that concussion patients avail themselves (at your referral doctor) of a full neuropsychological exam, QEEG, biofeedback treatment, EMDR, HBOT and even clinical hypnotherapy to try to get well from this devastating injury. YOUR job as the treating chiropractor is to screen for concussion and I have provided these questionnaires and course to help you do your job well.

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