Traumatic Brain Injury Claims
Assessing Claims, Negotiating Settlements, and Effectively Using Witnesses

FRIDAY, NOVEMBER 9, 2012
1pm Eastern    |    12pm Central   |   11am Mountain    |    10am Pacific

Today’s faculty features:

Dr. Glenn T. Goodwin, Consulting Neuropsychologist, Edmonds, Wash.
Paul Zukerberg, Founder, Zukerberg Law Center, Washington, D.C.
John Jerry Glas, Partner, Deutsch, Kerrigan & Stiles, New Orleans
Dr. Matthew J. DeGaetano, Whiplash & Brain Traumatology Consultant, Personal Injury Institute, Lewisville, Texas

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NEUROPSYCHOLOGICAL CONSULTATION IN TRAUMATIC BRAIN INJURY CASES

Glenn T. Goodwin, PhD, DABFE

gtgphd.com
What you end up believing depends on what you hear and who you hear it from.
Traumatic Brain Injury (TBI)

A spectrum of injury events along a continuum

- Mild concussive syndromes
- Prolonged or irreversible coma

Mild TBI

Severe TBI
Chronological Process of Evaluation and Treatment of TBI and Injury related Issues

- Emergency Room Evaluation
- Hospitalization, acute care and rehabilitation
- General Practitioner (postconcussive syndrome)
- Orthopedic Consultation (postconcussive syndrome)
- Chiropractic, Massage (postconcussive syndrome)
- Physical Therapy
- Neurological Consultation (postconcussive syndrome)
- Neuropsychological Consultation
Optimum Clinical and Medicolegal Scenario

- It is crucial to have the network of treating providers be on the same clinical and research awareness page with their background, training, clinical experience and understanding about TBI.
- Experts can be integrated into this process...directly or indirectly.
- Develop a solid medical foundation for the brain injury event through convergence of evidence memorialized in medical records and then with an experienced neurologist and/or physiatrist familiar with the current research and in active practice evaluating and treating patients with mild to severe TBI.
- (1) An initial neuropsychological consultation to provide an operational diagnostic assessment and clinical blueprint for refining the direction of further care and treatment...an objective evaluation of the effects of this injury event and all the injury related issues. (2) Obtain a final neuropsychological consultation down the road to make more precise estimates regarding the long-term prognosis.
- Obtain final assessments from the cognitive rehab providers (speech pathologists, occupational therapists, psychologists), vocational experts and life-care planners.
The Task for the Consulting Neuropsychologist

- The starting position should be one of “clinical neutrality”
- An opportunity to review and examine the injury issues within the context of all available background information
- To determine the probability of specific factors that may be contributing to the persistence of residual symptomatology
- Evaluating and bringing probable explanations to the surface and highlighting these issues
Neuropsychological Issues in Medicolegal Cases of TBI

Clinical Issues

1. Chronic pain, sleep disturbance, medication effects
2. PTSD, anxiety, depression, adjustment disorder
3. Postconcussive syndrome (PCS)
4. Somatization
5. Premorbid vulnerability
Neuropsychological Issues in Medicolegal Cases of TBI

Medicolegal Issues

1. Effects of litigation
2. Secondary Gain
3. Conviction of Disability/Exaggeration
4. Malingering
Clinical vs. Forensic Neuropsychological Consultation

**Clinical**
- Patient is the client
- Focus on diagnostics and treatment planning
- Informed consent
- Greater confidentiality
- Usually discoverable as medical records
- Reimbursable under insurance provisions

**Forensic**
- Retained expert
- Referral source is the client
- Focus is on case analysis and expert opinion
- Does not require informed consent
- Limited Confidentiality
- Can be non-discoverable
- Greater accountability

Shared elements: diagnostic interview and testing
GUIDELINES FOR OPTIMUM MEDICOLEGAL PRACTICE
Subjective complaints alone are not a reliable or valid basis for assessing postconcussive symptoms and aftereffects of TBI.
Neuropsychological examination provides objective analysis and documentation of neuropsychological symptoms of TBI, other injury related sequelae and non-injury related factors.
Pre-existing conditions and vulnerabilities are almost always factors that should be identified and considered in explaining current functioning after accident or injury.
Neuropsychological examination is standard practice in helping to verify legitimate residual neuropsychological symptoms of TBI and other injury related factors.

Initial neuropsychological examination…documenting the injury related issues, establishing the initial post injury baseline, providing a diagnostic blueprint for care and treatment

Pre-settlement follow-up neuropsychological examination…determining the final prognosis
Traumatic Brain Injury Claims

A Plaintiff’s Perspective

Paul Zukerberg
Zukerberg Law Center
Washington, DC

paul@zukerberg.com
(202) 232-6400
Summary

• Client intake
• Quantifying the client’s injury
• How to develop your case for trial
Your client intake should *always* include a TBI screening

Factually, was there a blow to the head, or forces sufficient to cause a TBI.

- Does the client report symptoms?
- Look for amnesia (a loss of memory at the time of the injury) - the main indicator of TBI (not loss of consciousness)
- Other TBI check-boxes at intake include reported:
  - headache, confusion, dizziness, blurry vision, fatigue, mood and personality changes, concentration issues, vomiting, seizures, slurred speech, weakness or numbness of the extremities, agitation or irritability and impulse control issues.
TBI can be Hidden

Client Fails to Report

• Preoccupied with other injuries or problems

• Ironically, brain injury can effect self-awareness

• Client may not fully realize his injury’s impact on those closest to him

Not in Medical Records

• Physician may lack experience in treating and evaluating patients with TBI

• Never asked to evaluate

• Diagnoses concussion – but recognizes recovery is variable
TBI is a **PROCESS**

- **IMPACT** is the event which *triggers* pathological changes in the client’s brain causing injury

- The damage following a TBI can be immediate - but can also develop over days, weeks, months or even years

- Disruptions to cerebral blood flow, or the alteration of pressure within the skull, can cause *secondary damage* to the brain which can be greater than the damage from the initial blow.
Discount DOI CT Scans

• “Day of Injury” (DOI) CT scans, given in the ER soon after impact, may actually be administered too soon to visualize the impending damage.

• In one study, the DOI (day of injury) MRI was read as normal, but the patient was comatose.

  • A follow-up MRI was completed 5 days later, which showed the beginnings of signal change.

  • But a complete picture of the damage was not seen until a scan 4 years later.
Quantifying Client’s Damages

• Neuropsychological Testing

• Deficits in cognition, memory, sensory processing, communication, attention and delayed reaction times are common, so is depression and personality changes

• Neuropsychological testing, by a clinical or forensic psychologist, is used to assess the extent of impairment to a particular skill

• Neurodiagnostic tests contain validity scores designed to capture malingering, lack of effort, and exaggeration of symptoms
Imagining Studies

- Only captures *gross* anatomy
  - MRI resolution goes down to approximately a millimeter
  - When we discuss brain cells, we are talking in microns – a *millionth* of a meter.
  - Changes at the *microscopic* level, where TBI occurs, cannot be seen at the *macroscopic* level of our current brain imaging technology
  - Diffuse axonal injury (DAI), the most common injury in TBI, cannot be seen with current imaging technology
Concussions Can’t be Seen

- CT scans and MRIs cannot detect a concussion

- If anything abnormal does show up on a CT scan or MRI, by definition, you client doesn’t have a concussion.

- He has something much more serious, such as a subdural hematoma or a focal brain lesion.
Diffusion Tensor Imaging ("DTI") accepted under Daubert Test

DTI illustrates the direction of water flow through the fiber tracts of the brain
Voxel Based Morphography ("VBM") is used to illustrate brain volume loss due to cellular death following TBI
SPECT, short for single emission computed tomography can create 3D studies of the brain. SPECT is particularly useful in cases of carbon monoxide poisoning cases and other toxic/anoxic brain injuries.
Investigation

• Check Glasgow Coma Score (GCS)
  • Both EMS report and Hospital Admission
  • Quick measure of consciousness that is now incorporated into ER forms
  • Numerous studies have shown that GCS is an accurate prognosticator of cognitive recovery and functional outcome
  • 3 test scores: Eye ("E"), Verbal ("V") and Motor Responses ("M")
    GCS add them up.
  • The lowest possible GCS is 3, representing a deep coma, and the highest is 15, which is a fully conscious person
• Be sure to carefully review statements of witnesses to project GCS at the time of impact
A LEGAL ODYSSEY: EVALUATING "RISK" IN BRAIN INJURY CASES

Presented By: John Jerry Glas

Deutsch, Kerrigan & Stiles, L.L.P.
New Orleans, Louisiana
jglas@dkslaw.com
DEFENSE EVALUATION

- Diagnostic Images
Injury

Effect
- Brain Herniation
- Midline Shift
- Mass Effect
- Edema
- Hematoma
Children with TBI were divided into groups, based on the following criteria: (i) mild TBI \((n = 14)\): GCS (Teasdale and Jennett, 1974) on admission 13–15, indicating alteration of conscious level (e.g. drowsiness, disorientation), no evidence of mass lesion on CT/MRI, and no neurological deficits; (ii) moderate TBI \((n = 46)\): GCS on admission 9–12, indicating significantly altered consciousness, with reduced responsiveness; and/or mass lesion or other evidence of specific injury on CT/MRI; and (iii) severe TBI \((n = 24)\): GCS on admission 3–8, representing coma, and mass lesion or other evidence of specific injury on CT/MRI. Implementation of this categorization procedure for severity successfully classified all children.
Report: Hey Rocky, did you get any brain damage?

Rocky: Yo, I don’t see any.
Trial # 1:  
Hairline Fracture

Trial # 2:  
Comminuted & Depressed Fracture
Trial # 1:
Hairline Fracture

Trial # 2:
Comminuted & Depressed Fracture

Midline Shift
No Midline Shift
**Trial # 1:**
Hairline Fracture

**Trial # 2:**
Comminuted & Depressed Fracture

**Mass Effect**

**No Mass Effect**
Trial # 1: Hairline Fracture

Trial # 2: Comminuted & Depressed Fracture

Hematoma

Hematomas
• Diagnostic Images

• Glasgow Coma Scale Scores
<table>
<thead>
<tr>
<th>Initial Symptoms</th>
</tr>
</thead>
<tbody>
<tr>
<td>LOC</td>
</tr>
<tr>
<td>GCS &lt; 15</td>
</tr>
<tr>
<td>Seizures</td>
</tr>
<tr>
<td>Vomiting</td>
</tr>
<tr>
<td>Dizziness</td>
</tr>
<tr>
<td>Anger</td>
</tr>
<tr>
<td>Impulsivity</td>
</tr>
<tr>
<td>Headaches</td>
</tr>
<tr>
<td>Loss of Appetite</td>
</tr>
<tr>
<td>Insomnia</td>
</tr>
<tr>
<td>Aphasia</td>
</tr>
<tr>
<td>Slurred Speech</td>
</tr>
<tr>
<td>Drainage of bloody or clear fluid through ears or nose</td>
</tr>
<tr>
<td>Weakness in limbs</td>
</tr>
</tbody>
</table>
Predictors of Outcome

Within all domains, injury severity (as measured by 24 h GCS), pre-injury adaptive abilities (VABS), and SES were significant predictors of 30 month outcomes. . .
<table>
<thead>
<tr>
<th>(E) Eye Opening</th>
<th>(V) Verbal Response</th>
<th>(M) Motor Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 = Spontaneous</td>
<td>5 = Normal Conversation</td>
<td>6 = Normal</td>
</tr>
<tr>
<td>3 = To Voice</td>
<td>4 = Disoriented Conversation</td>
<td>5 = Localizes To Pain</td>
</tr>
<tr>
<td>2 = To Pain</td>
<td>3 = Words, But Not Coherent</td>
<td>4 = Withdraws To Pain</td>
</tr>
<tr>
<td>1 = None</td>
<td>2 = No Words, Only Sounds</td>
<td>3 = Decorticate Posture</td>
</tr>
<tr>
<td></td>
<td>1 = None</td>
<td>2 = Decerebrate</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 = None</td>
</tr>
</tbody>
</table>
# Glasgow Coma Scale (Children)

<table>
<thead>
<tr>
<th>(E) Eye Opening</th>
<th>(V) Verbal Response</th>
<th>(M) Motor Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 = Spontaneous</td>
<td>5 = Coos, Babbles</td>
<td>6 = Normal</td>
</tr>
<tr>
<td>3 = To Voice</td>
<td>4 = Irritable Cry</td>
<td>5 = Withdraws</td>
</tr>
<tr>
<td>2 = To Pain</td>
<td>3 = Cries To Pain</td>
<td>To Touch</td>
</tr>
<tr>
<td>1 = None</td>
<td>2 = Moans To Pain</td>
<td>4 = Withdraws</td>
</tr>
<tr>
<td></td>
<td></td>
<td>To Pain</td>
</tr>
<tr>
<td></td>
<td></td>
<td>3 = Abnormal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Flexion</td>
</tr>
<tr>
<td></td>
<td></td>
<td>2 = Abnormal</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Extension</td>
</tr>
<tr>
<td></td>
<td></td>
<td>1 = None</td>
</tr>
</tbody>
</table>
### GLASGOW COMA SCALE

<table>
<thead>
<tr>
<th>EYE OPENING</th>
<th>SPONTANEOUSLY</th>
<th>A. RESP.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TO SPEECH</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>TO PAIN</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>NONE</td>
<td>1</td>
</tr>
<tr>
<td>VERBAL</td>
<td>OPIATE</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>CONFUSED</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>INAPPROPRIATE</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>INCOMPREHENSIBLE</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>OBEYS COMMANDS</td>
<td>0</td>
</tr>
<tr>
<td>MOTOR</td>
<td>WITHDRAWS</td>
<td>8</td>
</tr>
<tr>
<td></td>
<td>LOCALIZES</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>WITHDRAWS</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>FLEXION</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>EXTENSION</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>NONE</td>
<td>0</td>
</tr>
</tbody>
</table>

- **Pupils:** 1 Hour after admission
- **R:** Size: __________
- **L:** Size: __________
- **Pupils: REACT:**
- **Pupils: SLUGGSISH:**
- **Pupils: UNREACTIVE:**

### B. SYSTOLIC BP
- > 90: 4
- 70-89: 3
- 60-63: 2
- < 60: 1
- 0: 0

### C. CONVERT GCS
- 13-15: 4
- 9-12: __
- 6-8: 2
- 4-5: 1
- 3-0: 0

**REVISED TRAUMA SCORE:**

A + B + C = 12

Pupil Size: . . . .
Length of Time of LOC:

Mild: 0 to 30 minutes

Moderate: 30 min to 24 hours

Severe: 24 hours or more
For adults, cognitive deficits and symptoms are common in the acute stage, and the majority of studies report recovery for most within 3-12 months.

### Cumulative Percent of Head-Injured Subjects Who Returned to Work: % Returned to Work

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>N</th>
<th>1 mo</th>
<th>6 mo</th>
<th>12 mo</th>
<th>24 mo</th>
</tr>
</thead>
<tbody>
<tr>
<td>GCS</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>≤ 8 GCS</td>
<td>93</td>
<td>0%</td>
<td>13%</td>
<td>26%</td>
<td>37%</td>
</tr>
<tr>
<td>9-12 GCS</td>
<td>56</td>
<td>4%</td>
<td>44%</td>
<td>56%</td>
<td>64%</td>
</tr>
<tr>
<td>13-15 GCS</td>
<td>213</td>
<td>25%</td>
<td>63%</td>
<td>80%</td>
<td>83%</td>
</tr>
</tbody>
</table>
Where symptoms persist, compensation/litigation is a factor, but there is little consistent evidence for other predictors.

DEFENSE EVALUATION

- Diagnostic Images
- Glasgow Coma Scale Scores
- Neuropsychological Testing
• Impaired Function

• Area of Brain Associated w/ Function

• All Tests That Evaluate That Function

• Details About Tests & Answers

• Applicability of Practice Effect

• Daily Activities Associated With Function

• Other Functions Associated w/ Area of Brain
• Impaired Function

• **Area of Brain Associated w/ Function**

• All Tests That Evaluate That Function

• Details About Tests & Answers

• Applicability of Practice Effect

• Daily Activities Associated With Function

• Other Functions Associated w/ Area of Brain
1300 A.D.  Jan. 29, 2007
• Impaired Function
• Area of Brain Associated w/ Function
• All Tests That Evaluate That Function
• Details About Tests & Answers
• Applicability of Practice Effect
• Daily Activities Associated With Function
• Other Functions Associated w/ Area of Brain
- Impaired Function
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• Area of Brain Associated w/ Function
• All Tests That Evaluate That Function
• Details About Tests & Answers
• Applicability of Practice Effect
• Daily Activities Associated With Function
• Other Functions Associated w/ Area of Brain
“Based on the research – and actually one of the abstracts that Dr. Bell referred to, the research shows that people with damaged brains don’t benefit from being tested over again, and people who are normal do benefit from being tested again.”

Defense Neuropsychologist Trial Testimony
• Impaired Function
• Area of Brain Associated w/ Function
• All Tests That Evaluate That Function
• Details About Tests & Answers
• Applicability of Practice Effect
• Daily Activities Associated With Function
• Other Functions Associated w/ Area of Brain
• Impaired Function
• Area of Brain Associated w/ Function
• All Tests That Evaluate That Function
• Details About Tests & Answers
• Applicability of Practice Effect
• Daily Activities Associated With Function
• Other Functions Associated w/ Area of Brain
- Memory
- Language
- Initiation
- Judgment
- Impulse Control
- Social & Sexual Behavior
- Motor Function
- Problem Solving
- Diagnostic Images
- Glasgow Coma Scale Scores
- Neuropsychological Testing
- Pre-Morbid Ability
“Under Goodell’s new policy, all players will be required to take a baseline neuropsychological test – determining cognitive abilities, memory and motor skills – by the start of the 2007 season. That way, when a player has a concussion, he can be tested to determine what neurological changes have taken place.”
<table>
<thead>
<tr>
<th>Before</th>
<th>After</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Pre-Accident Testing</td>
<td>• Post-Accident Testing</td>
</tr>
<tr>
<td>• School Records</td>
<td>• Regression Equations</td>
</tr>
<tr>
<td>• Standardized Tests</td>
<td>• Clinical Interviews</td>
</tr>
<tr>
<td>• IQ Tests</td>
<td></td>
</tr>
<tr>
<td>• Interests &amp; Hobbies</td>
<td></td>
</tr>
<tr>
<td>• Employment</td>
<td></td>
</tr>
</tbody>
</table>
“On the Wide Range Achievement Test-3, he obtained a standard score of 88 on Reading, 64 on Spelling, and 65 on Math. These scores are significantly lower than expected from his academic history.”

Neuropsychologist’s Report
PRE-MORBID WRITING
SAMPLE # 1
• Afored  (afford)
• Atend   (attend)
• Canadate (candidate)
• Canidate (candidate)
• Cailber  (caliber)
• Canot   (cannot)
• Comment (commitment)
• Dose    (does)
• Extermaly (extremely)

• Finialy  (finally)
• Totaly  (totally)
• Tought  (taught)
• Unacepable (unacceptable)
• Voluteer (volunteer)
• Weather  (whether)
PRE-MORBID JOB APPLICATIONS

- Alabamer (State)
- Beverly Hills (City)
- Brocker (Job)
- Buisenn (Business)
- Jennafer (Wife)
- Jennafer (Wife)
- Luthran (Religion)
- Political Science (Degree)
- Politicail Scince (Degree)
Attn: Office of Admissions
University of La Verne
College of Law
5445 Balboa Boulevard
Encino, CA 91316

To: Admissions Committee

In the real world, the only tests that matter are the daily tests of how an individual lives his life and how hard that individual works to make his goals. For myself, that's the bottom line on success and failure.

As a person with dyslexia, I have never allowed my handicap to get in the way of my goals. As my personal history clearly shows, I have been successful in every endeavor I have attempted. Like everyone, there have been stumbling blocks along the way, but my personal drive and enthusiasm have allowed these incidents to be only momentary hindrances, never the end of a goal.

The facts point clearly to my endurance. My personal ambition has helped me receive my Bachelor of Arts Degree and is presently allowing me to work toward my MBA. This same enthusiasm has led me to establish and operate a successful sales firm.

While I performed inadequately on the LSAT, a test of this nature is not an accurate measure of my logistical skills and abilities. According to the Logistics Game Section of the test, I may not know where Jane is able to sit at a dinner party. That may be true, but life is not a dinner party. In the real world my background clearly shows that I have the determination and intelligence to be a success.

I firmly believe in the power of the individual to make changes in this world. My civic and military service are examples of my commitment to the community and, if I am accepted into your law school, this will ultimately allow me to further my goals of working with the elderly and aged in a social service environment. Someday I will do this.

Since I was a small child, my personal dream has always been to attend and graduate from law school. My personal hope at the moment is that I will be able to graduate from your law school but, if that is not the case, I will go to another law school and I will graduate. I have never allowed any situation to hold me back before and "surrender" is not part of my vocabulary.

I look forward to hearing from your committee in the near future.

Sincerely,

[Signature]
As a person with dyslexia, I have never allowed my handicap to get in the way of my goals. ...
• Diagnostic Images
• Glasgow Coma Scale Scores
• Neuropsychological Testing
• Pre-Morbid Ability
• Malingering
• Diagnostic Images
• Glasgow Coma Scale Scores
• Neuropsychological Testing
• Pre-Morbid Ability
• Malingering
• **Moaners & Groaners**
• Learn All Of Their Opinions
• Learn Stories Behind Each Opinion
• Dissect Anecdotal Stories
• Find Antidotal Stories
• Define Period Of Observation
• Determine Bias Of The Observer
“Normally, he’s good with kids. He has his Grandkids over and one of them spent the night, and he was short tempered. . .”

Plaintiff’s Sister
• Granddaughter dropped off at noon
• Promised to return that night
• Did not return for 24 hours
• Granddaughter was 6 months old
• Wife worked 7:00 a.m. to 3:00 p.m.
• Plaintiff “never lost his temper”
Granddaughter dropped off at noon
Promised to return that night
Did not return for 24 hours
Granddaughter was 6 months old
Wife worked 7:00 a.m. to 3:00 p.m.
Plaintiff “never lost his temper”
A LEGAL ODYSSEY: EVALUATING “RISK” IN BRAIN INJURY CASES

Presented By: John Jerry Glas

Deutsch, Kerrigan & Stiles, L.L.P.
New Orleans, Louisiana
jglas@dkslaw.com
MILD TRAUMATIC BRAIN INJURIES “MTBI”

- Post Concussion Syndrome
- Closed Head Trauma
- Soft Head Injury
- Blunt Head Injury
- Post-Head-Trauma Syndrome
Mechanism of Injury

- Mechanism of Injury

- Angular Acceleration  The mechanism of the trauma was previously thought to be a shearing of axons which result from abrupt acceleration and deceleration of brain tissue (784). During a low speed whiplash injury (7 mph) the head may be accelerated to 9-18 g (87).

- Since the brain is a soft structure, shear strains are created as the outer part of the brain moves at a different pace than the inner part of the brain. This is intensified as the momentum of the head changes rapidly in a sagittal direction during a whiplash trauma.

- Ommaya and Hirsch (116) studied the tolerances of primates to whiplash and calculated, by interpolation, that angular accelerations of 1800 rad/sec2 would result in a cerebral concussion in man about 50% of the time. They noted, however, that this threshold may very well be as low as 1600 rad/sec2. [Note that in Hypertext, the superscript 2, indicating a number squared, is reduced to a regular font 2.] As an interesting note, recent crash studies have produced angular accelerations of volunteers' heads of up to 1000 rad/sec2 in one study (1148) to as high as 1260 rad/sec2 in another (1175).

- And these are low speed crashes. The most important factors in whiplash-induced concussion are angular acceleration, flexion/extension tensions in the neck, and intracranial pressure gradients (787).
300 × 225 - New Study Confirms **Brain** Changes From Single **Mild TBI**
MILD TRAUMATIC BRAIN INJURIES “MTBI”

“TBI”

Traumatic Brain Injuries

NOT MILD!
Concussion

• A concussion is a type of **traumatic brain injury**, or TBI, caused by a bump, blow, or jolt to the head that can change the way your brain normally works. Concussions can also occur from a fall or a blow to the body that causes the head and brain to move quickly back and forth.

• Health care professionals may describe a concussion as a “mild” brain injury because concussions are usually not life-threatening. Even so, their effects can be serious.
Low Speed Crashes

The most important factors in whiplash-induced concussion are angular acceleration, flexion/extension tensions in the neck, and intracranial pressure gradients.

Head injury

• A head injury is any trauma that injures the scalp, skull, or brain. The injury may be only a minor bump on the skull or a serious brain injury.

Head injury can be either closed or open (penetrating).
• A closed head injury means you received a hard blow to the head from striking an object, but the object did not break the skull.
• An open, or penetrating, head injury means you were hit with an object that broke the skull and entered the brain. This usually happens when you move at high speed, such as going through the windshield during a car accident. It can also happen from a gunshot to the head.

Head injuries include:
• Concussion, the most common type of traumatic brain injury, in which the brain is shaken or the gradient sheer strains have occurred.
• Scalp wounds
• Skull fractures
• Head injuries may cause bleeding:
• In the brain tissue
• In the layers that surround the brain (subarachnoid hemorrhage and subdural hematoma)
Symptoms:

Headaches, dizziness, memory loss, inability to concentrate, sleep disorders, irritability, lightheadedness, vertigo, neck pain, photophobia, tinnitus, easy distractibility, impaired comprehension, forgetfulness, impaired logical thought, difficulty with new or abstract concepts, easily fatigued, apathy, outbursts of anger, mood swings, depression, loss of libido, personality changes and intolerance to alcohol.
PCS / MTBI Symptom Check List

Every firm should have their own PCS / MTBI check list.

Headaches, dizziness, memory loss, inability to concentrate, sleep disorders, irritability, lightheadedness, vertigo, neck pain, photophobia, tinnitus, easy distractibility, impaired comprehension, forgetfulness, impaired logical thought, difficulty with new or abstract concepts, easily fatigued, apathy, outbursts of anger, mood swings, depression, loss of libido, personality changes and intolerance to alcohol.
Physical Symptoms

- Dizziness
- Periods of "blacking out" or seizures
- Problems with coordination of hands, feet, or legs (drop things more often, balance problems)
- Stuttering or slurring
- Change in senses of smell or taste
- Blurry or double vision
- Ringing in the ears
- Headaches
- Fatigue
- More sensitive to bright light and/or loud noises
- Tingling or numbness in legs and arms
Emotional Symptoms

- Feeling of sadness and depression
- Crying spells or weepiness
- Suicidal thoughts or intentions
- Decreased or increased emotion (circle one)
- Low motivation
- Decreased of increased sex drive (circle one)
- Decreased or increased appetite (circle one)
- Decreased interest in “fun” activities
- Difficulties with sleeping (getting asleep or staying asleep)
- Irritability / easily frustrated
- Feeling of anxiety or fear
Aggressive Behavior After Head Injury

“TBI may go undiagnosed for months or years. Frequency of Aggressive Behavior in the acute stage ranges from 11% to 96% in TBI.

Patients with aggressive behavior were more likely to have injuries to the frontal lobe.

Non-aggressive patients were more likely to have diffuse brain injuries.”

Mild Traumatic Brain Injuries - MTBI

• Passengers rear ended at 10 mph have a 50% chance of sustaining a cerebral concussion.
• Lateral whiplash causes the greatest MTBI.
• Loss of consciousness is not a prerequisite for a concussion.
• Head trauma history could indicate a skull fracture - CT / MRI.
TBI should resolve is 6 months –
If not – it is probably permanent!
Primary Portal of Entry for Many PI Cases – Doctor of Chiropractic (DC)

• The DC is frequently the 1st Doctor a patient will see following a MVA.

• The DC is also the Doctor many patients see after months of symptoms without relief.

• Therefore, DC’s must understand acute and chronic Traumatic Brain Injuries!
In The Clinic

• Pupils dilated?
• Spell WORLD backwards.
• Count backwards from 100 by 7’s.
• Remember 3 out of 5 random words 30 minutes later.
• Name, address, friends, telephone numbers.
Traumatic Brain Injury & Serum S-100

- S-100 is a protein that is created after nerve cells in the brain after injury.
- 90% with cranial injury had elevated S-100 protein serum levels.

Diffuse Axonal Injury

- The acceleration / deceleration causes a shearing of axons known as Diffuse Axonal Injury.
- Swelling and then regression (atrophy) of the axons.
- Possible hematomas.
Testing:

- C T scan
- MRI (wait 3 months)
- EEG
- PET - positron emission tomography
- SPECT - single-photon emission CT
- BAER - brain stem auditory evoked responses
- Brain Mapping
- PSASAT - paced auditory serial addition test
www.mildtraumaticbrainInjury.com

- Fill out web form to receive
- Free Check list PCS / MTBI
- Free firm case practice audit
- Law firm MTBI training platform
Preparing for Trial

• Comprehensive Neurorehabilitation Evaluation
  
  • A board-certified neurologist or neuropsychiatrist will determine the extent of the injury, and the client’s current and future needs
  
  • Typically, includes a physical examination, family interviews, review of the medical records, neuropsychological testing and imaging studies
  
  • The goal is to define the appropriate interventional services to foster maximal educational, occupational and social success following TBI
Building your Client’s Case

- neuropsychological testing
- occupational therapy
- speech and language therapy
- physical therapy
Records Review

• School, military and employment records may contain evidence of pre-morbid functioning levels

• Prior psychological testing results
  
  • Military

  • Employment

  • Sports-related baseline tests for cognitive functioning - New
Pediatric Cases

• For children or young adults, your expert may rely upon an educational evaluation to define the appropriate interventional services to foster maximal educational and social success

• In children, TBI will most likely compromise future learning and academic achievement, or social and behavioral development, as the child grows older.

• Your educational evaluation will include options for school placement, special education services, which may include intensive, one-on-one daily support, cognitive therapy, speak and/or learning programs may be recommended.
Future Specials

• Medical follow-up to monitor progress and direct neurorehabilitation services

• The needs of the parent, guardian and/or caregiver must be considered, including ongoing support, family supportive psychotherapy, education, and training as to instructional or behavioral strategies, and periodic respite care

• Follow-up neurodiagnostic imaging to monitor cerebral atrophy and potential *hydrocephalus ex vacuo* – an abnormal buildup of cerebrospinal fluid in the ventricles of the brain, common in mild-moderate to severe TBI related to atrophy.
Life Care Plan

• Your expert’s recommendations are typically then provided to a life-care planner

• Investigates ways to provide the recommended services within a comprehensive life care plan, and associated costs

• An economist will reduce the number to its present value
Final Thoughts

• Stop, look and listen – to your client

• Ask the hard, intrusive personal questions
  • Intra-family relations
  • employment
  • mood and personality changes

• TBI clients can tax your patience.
  • Behavior which is seemingly annoying – repeated phone calls asking the same questions – may be signs and symptoms of the brain injury itself
  • In the end, it’s worth it if you can fund a life care plan and do a service to a client in need.
Bracing For The Siren Song:
Trying A Brain Injury Jury Trial

Presented By:
John Jerry Glas

Deutsch, Kerrigan & Stiles, L.L.P.
New Orleans, Louisiana
jglas@dkslaw.com
It's Time For Ex-NFL Players to Be Scared, Very Scared

Feb 23, 2011 – 1:54 PM

Andre Waters.
Shane Dronett.
Now Dave Duerson.

This is at least the third suicide involving a former NFL player within the last five years, which qualifies as an epidemic, which means this is the continuation of a horror story with no end in sight.

Jessie Tuggle paused over the phone from his home in the Atlanta area, and then he cleared his throat.
• Separate Evidence & Testimony
Injury

Impairment
Injury
(Neurosurgeon/Neurologist)

Impairment
(Neuropsychologist)
Frontal Lobe Injury
(Neurosurgeon/Neurologist)

Impaired Memory
(Neuropsychologist)
Impaired Memory
(Neuropsychologist)
Impaired Memory
(Neuropsychologist)

Must have been a Frontal Lobe Injury!
Impaired Auditory Memory

(Neuropsychologist)

Must have been a Frontal Lobe Injury, which must have caused the Impairment!
Impairment
(Neuropsychologist)

Injury
“[The neuropsychologist] was limited by the trial court to the extent that she was allowed to testify regarding the existence of a brain injury because she is not a medical Doctor. She did testify that it was possible for a patient to demonstrate neuropsychological deficits with negative CAT scans, EMGs, MRIs, and ENGs as plaintiff did. She explained that this occurs when the brain injury is caused by nerve shearing which does not show up photographically but does show up behaviorally. Contradicting Dr. Culver, She further testified that loss of consciousness results from an injury to the brain stem but plaintiff may have injured some other part of the brain.”

- Bernard v. Lott, 666 So.2d 702, 704-705 (La. 4 Cir. 12/28/1995)
• Separate Evidence & Testimony
• Identify “Missing” Injuries
The Skull Hits First
Then The Brain Hits, Causing The Coup Injury.
The Skull Hits First

COUP INJURY
There Is Movement Away From The Opposite

CONTRA-COUP INJURY
The Brain Hits, Causing The Coup Injury.
There Is Movement Away From The Opposite,

CONCRETE

COUP INJURY
There is movement away from the opposite, COUP INJURY.
Causing The Contra-Coup Injury.
CONCRETE

CONTRA-COUP INJURY

COUP INJURY
Separate Evidence & Testimony

Identify “Missing” Injuries

Establish Strengths
Cognitive Strengths
(Average Range Or Higher)

• Mental Arithmetic Skills
• Auditory Attention/Working Memory
• Expressive Vocabulary
• Delayed Nonverbal Memory
• Right Hand Motor Speed
• Nonverbal Intelligence
• Spatial Planning
• Perception of Visual Details
• Visual-Construction Skills
• Nonverbal Reasoning
• Social Conventions & Judgment
Cognitive Strengths
(“Not A Concern”)

- Nonverbal Intelligence
- Fluid Reasoning
- Visual-Perceptual Reasoning
- Processing Speed
- Visual Scanning
- Perceptual-Motor Speed
- Single-Word Receptive Language
- Single-Word Expressive Language
- Naming of Body Parts
- Comprehension of Oral Language

- Visual-Spatial Skills
- Graphomotor construction
- Reproduction of Block Designs
- Visuomotor Precision
- Initial Learning
- Recall of Verbal Information
- Short-term Free Recall
- Long-term Free Recall
- Visual Memory
- Basic Categorical & Conceptual Knowledge
• Separate Evidence & Testimony
• Identify “Missing” Injuries
• Establish Strengths
• Identify Unaffected Functions For “Damaged” Lobe
Cognitive Strengths Associated With Frontal Lobe

- Mental Arithmetic Skills
- Auditory Attention/Working Memory
- Expressive Vocabulary
- Delayed Nonverbal Memory
- Right Hand Motor Speed
- Nonverbal Intelligence
- Spatial Planning
- Perception of Visual Details
- Visual-Construction Skills
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Cognitive Strengths Associated With Frontal Lobe

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- Separate Evidence & Testimony
- Identify “Missing” Injuries
- Establish Strengths
- Identify Unaffected Functions For “Damaged” Lobe
- Address Poor Performances
# Comparison of Performance

<table>
<thead>
<tr>
<th>Memory Testing</th>
<th>Performance on 11/9/99</th>
<th>Performance on 7/17/01</th>
<th>Performance on 1/28/02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory Immediate</td>
<td>92 (30%)</td>
<td>94 (34%)</td>
<td>102 (55%)</td>
</tr>
<tr>
<td>Auditory Delayed</td>
<td>94 (34%)</td>
<td>102 (55%)</td>
<td>105 (63%)</td>
</tr>
<tr>
<td>Visual Immediate</td>
<td>84 (14%)</td>
<td>81 (10%)</td>
<td>91 (27%)</td>
</tr>
<tr>
<td>Visual Delayed</td>
<td>88 (21%)</td>
<td>75 (5%)</td>
<td>94 (34%)</td>
</tr>
<tr>
<td>Working Memory</td>
<td>76 (5%)</td>
<td>76 (5%)</td>
<td>83 (13%)</td>
</tr>
<tr>
<td>General Memory</td>
<td>93 (32%)</td>
<td>86 (18%)</td>
<td>150 (50%)</td>
</tr>
</tbody>
</table>
## Comparison of Performance

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<tr>
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<th>Performance on 7/17/01</th>
<th>Performance on 1/28/02</th>
</tr>
</thead>
<tbody>
<tr>
<td>Auditory</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Immediate</td>
<td>average</td>
<td>average</td>
<td>average</td>
</tr>
<tr>
<td>Delayed</td>
<td>average</td>
<td>average</td>
<td>average</td>
</tr>
<tr>
<td>Visual</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Immediate</td>
<td>average</td>
<td>average</td>
<td>average</td>
</tr>
<tr>
<td>Delayed</td>
<td>average</td>
<td>average</td>
<td>average</td>
</tr>
<tr>
<td>Working Memory</td>
<td>low average</td>
<td>low average</td>
<td>low average</td>
</tr>
<tr>
<td>General Memory</td>
<td>average</td>
<td>average</td>
<td>average</td>
</tr>
<tr>
<td>COGNITIVE ABILITY</td>
<td>COMPARED TO PRE-ACCIDENT ABILITY, PERFORMANCE WAS:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>-----------------------------------</td>
<td>--------------------------------------------------</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Worse</td>
<td>Consistent</td>
<td>Better</td>
</tr>
<tr>
<td>Auditory Immediate</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Auditory Delayed</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Visual Immediate</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual Delayed</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Visual Reproduction I</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Visual Reproduction II</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Working Memory</td>
<td>✓</td>
<td></td>
<td></td>
</tr>
<tr>
<td>General Memory</td>
<td></td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>
• Separate Evidence & Testimony
• Identify “Missing” Injuries
• Establish Strengths
• Identify Unaffected Functions For “Damaged” Lobe
• Address Poor Performances
• Advocate For Accountability
Reduced Self-Control (Disinhibition)

No Control Over Impulse (Irresistible Impulse)
Irresistible

Not Resisted
“The line between an irresistible impulse and an impulse not resisted is probably no sharper than between twilight and dusk.”

Irresistible
(involuntary conduct)

Not Resisted
(voluntary conduct)
“... I can tell you that [plaintiff] is going to break those laws that will put him in some kind of facility within a very short time if he lived independently by himself. . .

I don’t think it’s his cognitive skills that are the problem. I don’t think it’s his memory. . . I think it’s his impulsivity and his lack of self-control and his judgment that are damning him.”

Deposition of Beth Salcedo, MA, SLP, CCC, 6/10/09, p. 132, line 18 et seq
- What is plaintiff’s I.Q.?
- Was plaintiff under influence of drugs, ETOH, meds?
- Does plaintiff recall his behavior?
- Did plaintiff understand physical act & consequences?
- Could plaintiff distinguish between right & wrong?
- Did plaintiff know “nature and quality” of the act?
- Did plaintiff know behavior was illegal?
- Did plaintiff believe behavior was immoral?
- Did plaintiff feel guilty?
- Did plaintiff plead guilty?
• Did plaintiff physically lose control over extremities?
• Did plaintiff plan or organize before (premeditated)?
• Was behavior self-endangering or self-defeating?
• Would plaintiff have waited if officer there?
• Did plaintiff lose all ability to control behavior?
• How much disinhibition is required for the behavior?
• How did you determine the impulse was irresistible?
“There is, in short, no objective basis for distinguishing between offenders who were undeterrable and those who were merely undeterred, between the impulse that was irresistible and the impulse not resisted, or between substantial impairment of capacity and some lesser impairment.”

- Separate Evidence & Testimony
- Identify “Missing” Injuries
- Establish Strengths
- Identify Unaffected Functions For “Damaged” Lobe
- Address Poor Performances
- Advocate For Accountability
- Attack Medical Studies
American Children Under The Age Of 5
20,000,000

Cases Of TBI
50,000

Study Population
122

Infants
27

Mild
4
Results. A clear relationship was documented between injury severity and cognitive performance.
Exclusion Criteria

- Previous TBI
- Pre-Existing Physical, Neurologic, Psychiatric, Or Development Disorder.
- Penetrating Head Injury
- TBI Caused By Child Abuse
Inclusion Criteria

• Age at injury (3-13)
• Documented evidence of TBI including period of altered consciousness
• Ability to complete cognitive evaluations
• Completions of all three evaluations
Prior Study

Exclusion Criteria

Earlier Study:

Inclusion Criteria

- Age at injury (2-7)
- Documented evidence of TBI including period of altered consciousness
- Medical Records Sufficient To Determine Injury Severity
- Ability To Complete Cognitive Evaluations
- Completions Of All Three Evaluations
- English As First Language
- Parents Competent With English
Children with TBI were divided into groups, based on the following criteria: (i) mild TBI \((n = 14)\): GCS (Teasdale and Jennett, 1974) on admission 13–15, indicating alteration of conscious level (e.g. drowsiness, disorientation), no evidence of mass lesion on CT/MRI, and no neurological deficits; (ii) moderate TBI \((n = 46)\): GCS on admission 9–12, indicating significantly altered consciousness, with reduced responsiveness; and/or mass lesion or other evidence of specific injury on CT/MRI; and (iii) severe TBI \((n = 24)\): GCS on admission 3–8, representing coma, and mass lesion or other evidence of specific injury on CT/MRI. Implementation of this categorization procedure for severity successfully classified all children.
**TABLE 2.** Injury and Medical Characteristics of the Sample According to Age at Injury and \( \text{Infant TBI} \)

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coma characteristics</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GCS score (24 h), mean (95% CI)</td>
<td>13 (10.8–15.0)</td>
<td>11.4 (10.2–12.6)</td>
<td>9.0 (7.3–10.7)</td>
</tr>
<tr>
<td>Coma of &gt;1 h, no. (%)</td>
<td></td>
<td>13 (86.7)%</td>
<td>8 (100.0)</td>
</tr>
<tr>
<td>Abnormal CT/MRI findings, no. (%)</td>
<td>11 (73.3)</td>
<td>5 (62.5)</td>
<td></td>
</tr>
<tr>
<td>Fractures (nonlinear)</td>
<td>9 (33.3)</td>
<td>2 (15.4)</td>
<td></td>
</tr>
<tr>
<td>Extradural/subdural bleeding</td>
<td>1 (6.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Edema</td>
<td>1 (12.5)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Site of pathologic condition, no. (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Frontal only</td>
<td></td>
<td>1 (12.5)</td>
<td></td>
</tr>
<tr>
<td>Extrafrontal only</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Subcortical</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Multiple sites</td>
<td>1 (6.7)</td>
<td>1 (12.5)</td>
<td>1 (8)</td>
</tr>
<tr>
<td>Neurologic signs, no. (%)</td>
<td>7 (46.7)</td>
<td>6 (75.0)</td>
<td>1 (8)</td>
</tr>
<tr>
<td>Cause of injury, no. (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MVA, passenger</td>
<td>1</td>
<td>2 (12.5)</td>
<td>2 (12.5)</td>
</tr>
<tr>
<td>MVA, pedestrian</td>
<td></td>
<td>2 (12.5)</td>
<td>1 (8)</td>
</tr>
<tr>
<td>MVA, bicycle</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fall</td>
<td>3 (75.0)</td>
<td>12 (75.0)</td>
<td>1 (6.3)</td>
</tr>
<tr>
<td>Blow</td>
<td>2 (12.5)</td>
<td>2 (12.5)</td>
<td>1 (8)</td>
</tr>
</tbody>
</table>

CI indicates confidence interval; MVA, motor vehicle accident.
<table>
<thead>
<tr>
<th>Test</th>
<th>Mild TBI mean (SE)</th>
<th>Moderate TBI mean (SE)</th>
<th>Severe TBI mean (SE)</th>
<th>Controls mean (SE)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Expressive measures</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>EOWPVT (standard score)*)**</td>
<td>111.5 (6.6)</td>
<td>102.0 (4.7)</td>
<td>88.4 (5.6)</td>
<td>104.4 (4.4)</td>
</tr>
<tr>
<td>Acute</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 months</td>
<td>117.1 (5.3)</td>
<td>106.1 (3.8)</td>
<td>94.4 (4.5)</td>
<td>105.7 (3.6)</td>
</tr>
<tr>
<td>30 months</td>
<td>120.0 (5.8)</td>
<td>112.7 (4.1)</td>
<td>94.8 (4.8)</td>
<td>110.4 (3.8)</td>
</tr>
<tr>
<td>BST: information (raw score)*)b**</td>
<td>19.2 (3.4)</td>
<td>23.6 (2.4)</td>
<td>20.6 (2.9)</td>
<td>25.7 (22.3)</td>
</tr>
<tr>
<td>Acute</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 months</td>
<td>28.1 (3.3)</td>
<td>31.4 (2.3)</td>
<td>24.7 (2.8)</td>
<td>30.6 (2.3)</td>
</tr>
<tr>
<td>30 months</td>
<td>32.1 (2.5)</td>
<td>35.1 (1.7)</td>
<td>30.4 (2.1)</td>
<td>34.4 (1.7)</td>
</tr>
<tr>
<td>BST: length (raw score)*)b**</td>
<td>8.7 (0.9)</td>
<td>7.9 (0.7)</td>
<td>8.6 (0.8)</td>
<td>9.4 (0.6)</td>
</tr>
<tr>
<td>Acute</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 months</td>
<td>10.3 (1.2)</td>
<td>11.1 (0.8)</td>
<td>9.3 (1.0)</td>
<td>11.7 (0.8)</td>
</tr>
<tr>
<td>30 months</td>
<td>11.0 (0.8)</td>
<td>12.1 (0.6)</td>
<td>11.6 (0.7)</td>
<td>12.1 (0.6)</td>
</tr>
<tr>
<td>VFT (age equivalent)b**</td>
<td>15.5 (2.2)</td>
<td>15.3 (1.4)</td>
<td>14.1 (1.9)</td>
<td>16.7 (1.5)</td>
</tr>
<tr>
<td>Acute</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12 months</td>
<td>16.2 (1.7)</td>
<td>18.2 (1.1)</td>
<td>16.1 (1.5)</td>
<td>18.9 (1.1)</td>
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*P < 0.05; *P < 0.01; **P < .001; *significant main effect of severity; **significant main effect of time.
### Table 3  Language test results at acute, 12 and 30 months post-injury

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</table>
| EOWPVT (standard score)
  Acute                         | 111.5 (6.6)        | 102.0 (4.7)            | 88.4 (5.6)           | 104.4 (4.4)       |
| 12 months                      | 117.1 (5.3)        | 106.1 (3.8)            | 94.4 (4.5)           | 105.7 (3.6)       |
| 30 months                      | 120.0 (5.8)        |                        | 94.8 (4.8)           |                   |
| BST: information (raw score)
  Acute                         | 19.2 (3.4)         | 23.6 (2.4)             | 20.6 (2.9)           | 25.7 (22.3)       |
| 12 months                      | 28.1 (3.3)         | 31.4 (2.3)             | 24.7 (2.8)           | 30.6 (2.3)        |
| 30 months                      | 32.1 (2.5)         |                        | 30.4 (2.1)           |                   |
| BST: length (raw score)
  Acute                         | 8.7 (0.9)          | 7.9 (0.7)              | 8.6 (0.8)            | 9.4 (0.6)         |
| 12 months                      | 10.3 (1.2)         | 11.1 (0.8)             | 9.3 (1.0)            | 11.7 (0.8)        |
| 30 months                      | 11.0 (0.8)         | 12.1 (0.6)             | 11.6 (0.7)           |                   |
| VFT (age equivalent)           | 15.5 (2.2)         | 15.3 (1.4)             | 14.1 (1.9)           | 16.7 (1.5)        |
| 12 months                      | 16.2 (1.7)         | 18.2 (1.1)             | 16.1 (1.5)           | 18.9 (1.1)        |
| 30 months                      | 20.5 (1.5)         | 22.6 (1.0)             | 20.2 (1.2)           | 23.8 (1.0)        |
| **Receptive measures**         |                    |                        |                      |                   |
| PPVT-R (standard score)
  Acute                         | 100.3 (6.0)        | 99.2 (4.1)             | 82.6 (4.9)           | 93.6 (4.1)        |
| 12 months                      | 103.6 (5.5)        | 99.7 (3.8)             | 85.4 (4.9)           | 99.0 (3.8)        |
| 30 months                      | 106.0 (4.9)        | 97.8 (3.3)             | 85.4 (4.0)           | 95.5 (3.3)        |
| TACL-R (deviation quotient)*** |                    |                        |                      |                   |
| Acute                          | 105.0 (5.0)        | 95.9 (3.6)             | 81.4 (3.9)           | 97.9 (3.4)        |
| 12 months                      | 104.6 (5.0)        | 98.8 (3.6)             | 86.8 (3.9)           | 99.5 (3.4)        |
| 30 months                      | 98.8 (4.9)         | 102.0 (3.6)            | 86.0 (3.8)           | 96.7 (3.3)        |

*P < 0.05; **P < 0.01; ***P < .001; *significant main effect of severity; **significant main effect of time.
## Table 3  Language test results at acute, 12 and 30 months post-injury

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