Mild TBI: Effects of Concussion and Pre-Morbid Personality
Ronald M. Ruff, PhD, ABPP

Overview
- Brain-based Emotional Regulation
- Differential Diagnosis of Emotions
  - Personality Characteristics
  - Mood
- Role of Premorbid Personality Styles
- Postconcussional Disorder

Conflict of Interest Disclosure
Ronald Ruff, Ph.D.
- Royalty: Author of 4 Neuropsychological Tests
  Psychological Assessment Resources, Inc.
  - Ruff Figural Fluency Test
  - Ruff 2&7 Selective Reminding Test
  - Ruff–Light Trail Light Learning Test
  - Ruff Neurobehavioral Inventory
Emotional Systems of the Brain

- Arousal Motivation System – cortical, limbic and brain-stem components
- Perceptual & Memory System – posterior neocortex and hippocampal formation
- Action Selection System – frontal neocortex, basal ganglia and parts of the thalamus

Functional Systems

- Action Selection
- Perception and Memory
- Arousal and Motivation
- Working Memory
- Selective Attention
- Emotional Regulation
- Emotional Conditioning
- Arousal
- Basic Goals
• Disorder of Arousal-Motivation
  • Depression and Dysthymia
  • Bipolar Disorder
  • Posttraumatic Stress Disorder

- Disorder of Action and Selection
  - Conduct Disorder
  - Attention Deficit Hyperactivity
  - Obsessive-Compulsive Disorder
  - Schizophrenia
  - Tourette Disorder

Emotional Regulation
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Potential Predictors of Brain Based Emotional Impairment

- Location of Brain Damage
  - Orbitofrontal lobe damage can result in “acquired sociopathy” (Blair and Cipolotti, 2000)
  - Left orbitofrontal lobe damage can lead to poor interpretations of social situations (Cicerone and Tanenbaum, 1997)
  - Ventral frontal lobes is associated with poor recognition of emotional expression (Hornak, Rolls and Wade, 1996)

Emotional Functioning

- Maintaining motivational during activity
- Switching motivational contingencies
- Permitting flexibility
- Emotional learning including classical conditioning of fear response (PTSD, anxiety syndromes, phobias)

7 Core Emotions
- Rage, fear, panic, lust, care, seeking & play

Location

<table>
<thead>
<tr>
<th>Location</th>
<th>Emotional Functioning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cortical Orbitofrontal</td>
<td>• Maintaining motivational during activity</td>
</tr>
<tr>
<td></td>
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<tr>
<td></td>
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<tr>
<td>Limbic amygdala</td>
<td>• Emotional learning including classical conditioning of fear response (PTSD, anxiety syndromes, phobias)</td>
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<td>Brainstem</td>
<td>7 Core Emotions</td>
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Brain-based Emotional Regulation

Differential Diagnosis of Emotions
- Personality Characteristics
- Mood

Role of Premorbid Personality Styles
Postconcussional Disorder

WE ALL HAVE CERTAIN LONGSTANDING PERSONALITY CHARACTERISTICS

At the same time we also have different daily mood states
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Emotional Problems – DSM IV

- Acute Status – Axis I
  current emotional functioning or mood, e.g., anxious, depressed - if severe leads to Disorder

- Personality Traits – Axis II
  longstanding personality characteristics, e.g., paranoid, histrionic, schizoid, narcissistic – we all a features or trait but if severe leads to Disorder

Acute Status – Axis I
- Major Depression
- Adjustment Disorder
- Anxiety Disorder

Personality – Axis II
- Personality Change due to Medical Condition

DSM = Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition
American Psychiatric Association (1994)
Brain Based Emotional Changes
- Orbito-frontal damage will likely result in permanent emotional and psychosocial problems
- Avoid rendering an optimistic prognosis (just as you would with a developmental disorder such as autism or Asperger’s syndrome)
- Examine level of dysfunction in therapeutic context vs. the “real world”

Consequences of Emotional Disturbances
- Impoverished social relationships
- Inability to return to work

Brooks, McKinley, Symington et al, 1987; Malia, Powell, Torode, 1995

Consequences of Emotional Disturbances
- For relatives emotional disturbances are often a greater burden than physical and cognitive impairments

Brooks, Campsie, Symington et al, 1986; Kinsella, Packer, Oliver, 1991
Koskinen, 1998

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- Postconcussional Disorder
Persistent problems following a Mild TBI are caused by psychological factors. The psychological factors can be either premorbid and/or post-accident.

Mild TBI can cause neuropathology that engenders symptoms. In some patients this results in permanent problems.

129 (PCD) patients examined for Axis I & II disorders according to following the Millon Clinical Multiaxial Inventory. 4 subgroups emerged:

- 36.4% no psychopathologies
- 4.7% Axis I disorder
- 24.8% Axis II disorder
- 24.0% Axis I & II disorders


63.5% endorsed emotional pathologies. Individuals with Axis I & II pathologies (24%)

- greatest number of emotional complaints in a clinical interview
- lowest neurocognitive test scores
  - motor skills
  - verbal abilities
  - memory
Conclusions

- Combination of both Axis I and II psychopathology leads to greater impairment following MTBI.
- No significant differences were identified between litigants and non-litigants.
- 36.4% of individuals with PCD had psychopathologies.


Predisposing Factors in Mild TBI patients

- Psychiatric Conditions (e.g. depression)
- Personality Traits (e.g. perfectionist)
- Coping Abilities (e.g. poor stress management)
- Intelligence Level (e.g. lower IQ, Learning Dis.)
- Demographic Characteristics (e.g. > 50 years)
- Medical Conditions (e.g. pain, previous TBI)

### Mild TBI: Effects of Concussion and Pre-Morbid Personality

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<table>
<thead>
<tr>
<th>Case 1</th>
<th>Case 2</th>
<th>Case 3</th>
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<tbody>
<tr>
<td>Postmorbid Brain-based</td>
<td>Reactive</td>
<td>Pre-injury</td>
</tr>
<tr>
<td>Problem Level</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overwhelming</td>
<td>Miserable Minority</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate</td>
<td></td>
<td></td>
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<tr>
<td>Low</td>
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#### Variable Etiology of PCD

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<td>Overwhelming</td>
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</table>

#### Personality Disorders – Axis II

- **Antisocial Personality Disorder**
  - Pervasive pattern of disregard for and violation of the rights of others occurring since age 15 with 3 (or more) of the following:
    - A that are grounds for arrest
    - Conning other for personal profit or pleasure
    - Impulsivity or failure to plan ahead
    - Physical fights or assaults
    - Reckless disregard for safety of self and others
    - Lack of consistent work or financial responsibility
    - Lack of remorse and rationalizing poor behavior

- **Histrionic Personality Disorder**
  - Pattern of excessive emotionality and attention seeking beginning in early adulthood with 5 (or more) of the following features:
    - Uncomfortable if not the center of attention
    - Inappropriate sexual seductiveness
    - Rapidly shifting & shallow expression of emotions
    - Using physical appearance to draw attention
    - Impressionistic communications with lack of detail
    - Theatrical and exaggerated expression of emotions
    - Easily influenced by others
    - Considers relationships as more intimate than they actually are
How can personality disorders color symptom presentations?

- Pain presentation of an antisocial patient: “I got in a fight and really hurt the other person and all that happened to me was that I fell and busted my knee.”
- Pain presentation of a histrionic patient: “I almost was killed in this terrible accident, and now my leg hurts as if someone had jammed an ice pick into my knee.”

<table>
<thead>
<tr>
<th>Personality Style</th>
<th>Pre-TBI Character</th>
<th>Post-TBI Reaction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dependency</td>
<td>Excessive need to be taken care of; submissive behavior; fear of separation</td>
<td>Paralyzed by symptoms, if critical erosion occurs to further reduce independence</td>
</tr>
<tr>
<td>Borderline</td>
<td>Pattern of instability in interpersonal relationships &amp; self perception with fear of abandonment</td>
<td>Exacerbation of personality organization, including despair, panic, impulsiveness, self-destructive acts</td>
</tr>
<tr>
<td>Perfectionist</td>
<td>Sense of self derived accomplishment, which is frequently obsessive</td>
<td>Catastrophic if drop in performance is perceived</td>
</tr>
<tr>
<td>Narcissistic</td>
<td>Overestimate of abilities and inflating accomplishments, need for admiration &amp; lack of empathy</td>
<td>Minimization of denial of symptoms; if failure results, crash of self-esteem can result in catastrophic reaction</td>
</tr>
<tr>
<td>PTSD</td>
<td>Prior stressors produced an emotional reaction to fear and</td>
<td>Decreased coping ability; effect of traumas with exaggerated reaction to current crisis</td>
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- Postconcussional Disorder

Definition: Postconcussional Disorder
DSM – IV Diagnostic Criteria
- Multidimensional symptoms:
  - Cognitive
  - Physical
  - Emotional
- 3 or more months post-accident
- Effects on educational and vocational functioning

Multidimensional symptoms:
- Cognitive
- Physical
- Emotional
- 3 or more months post-accident
- Effects on educational and vocational functioning


Estimate of Pre-TBI Functioning

<table>
<thead>
<tr>
<th>Moderate-severe TBI</th>
<th>Mild TBI</th>
</tr>
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<tbody>
<tr>
<td>Deficits are pronounced</td>
<td></td>
</tr>
<tr>
<td>Pre-injury estimate is relevant but less essential</td>
<td></td>
</tr>
<tr>
<td>Deficits are more subtle</td>
<td></td>
</tr>
<tr>
<td>Pre-morbid estimate is essential</td>
<td></td>
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</table>

Causes for Poor Outcome
- Neurogenic
- Psychogenic
- Co-morbid Medical or Emotional complications
- Pre-morbid factors
- Financial gain (malingering)
- Any combination of the above

Neuropsychologists Role:  
Distinguish between brain vs. non-brain based etiologies

<table>
<thead>
<tr>
<th>BRAIN BASED</th>
<th>NON-BRAIN BASED</th>
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</thead>
<tbody>
<tr>
<td>❌ Neuro-cognitive decline</td>
<td>❌ Psychogenic</td>
</tr>
<tr>
<td>❌ Neuro-emotional dysregulation</td>
<td>❌ Co-morbid Medical or Emotional complications</td>
</tr>
<tr>
<td>❌ Neuro-physical signs and symptoms</td>
<td>❌ Pre-morbid factors</td>
</tr>
<tr>
<td></td>
<td>❌ Financial gain (malingering)</td>
</tr>
</tbody>
</table>

Proposed Solution  
Modifiers for Postconcussional Disorder

1. PCD with neuro-cognitive features  
2. PCD with neuro-emotional features  
3. PCD with neuro-physical features (i.e. neurological signs and symptoms)  
4. PCD with mixed features

1. PCD with Neurocognitive Features

Post-traumatic cognitive clusters includes according to the DSM-IV

- Attention deficits affecting  
  - Concentration  
  - Shifting  
  - Focus of attention  
  - Performing simultaneous cognitive tasks  
- Memory deficit affecting  
  - Learning  
  - Recalling information
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2. PCD with Neuro-emotional Features

- Emotional Residuals
- Physical Residuals
- Cognitive Deficits

Post-traumatic psychological Problems according to DSM-IV-TR

- Irritability or aggression on little or no provocation
- Anxiety
- Depression
- Affective liability
- Apathy or lack of spontaneity
- Other changes in personality (e.g., social or sexual inappropriateness)

Emotional Residuals

<table>
<thead>
<tr>
<th>NEURO-EMOTIONAL</th>
<th>EMOTIONAL REACTIONS</th>
</tr>
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<tbody>
<tr>
<td>Affective liability</td>
<td>Irritability or aggression on little or no provocation</td>
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<td>Apathy or lack of spontaneity</td>
<td>Anxiety</td>
</tr>
<tr>
<td>Other changes in personality (e.g., social or sexual inappropriateness)</td>
<td>Reactive Depression</td>
</tr>
<tr>
<td>Endogenous Depression</td>
<td>Adjustment Disorder with Anxious and Depressive Features</td>
</tr>
<tr>
<td>Disinhibition</td>
<td></td>
</tr>
</tbody>
</table>

3. PCD with Neuro-physical or Neurological Features

- Neurological signs
  - More objective and observable
- Neurological symptoms
  - More subjective and non-specific
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3. PCD with Neuro-physical or Neurological Features

- Physical Neurological Features
  - Emotional Residuals
  - Cognitive Deficits

4. PCD with Mixed Features

- A mixture of documented neuro-cognitive deficits
- Brain-based and or reactive emotional residua
- Neurological signs and symptoms

PCD – Common Post-traumatic Physical Residuals

- DSM-IV-TR
  - Physical fatigue
  - Disordered sleep
  - Headaches
  - Vertigo and dizziness
  - Physical fatigue
  - Seizure Disorder

- ICD-10
  - Disordered sleep
  - Headaches
  - Vertigo and dizziness

3. PCD with Neuro-physical Features

<table>
<thead>
<tr>
<th>NEUROLOGICAL SIGNS</th>
<th>PHYSICAL SYMPTOMS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Post-traumatic seizure disorder</td>
<td>Physical fatigue</td>
</tr>
<tr>
<td>Intracranial lesions not requiring surgery</td>
<td>Disordered sleep</td>
</tr>
<tr>
<td>Anosmia/hyposmia</td>
<td>Headaches</td>
</tr>
<tr>
<td>Other cranial nerve deficits</td>
<td>Vertigo or dizziness</td>
</tr>
<tr>
<td>Visual field cuts, diplopia, or other visual symptoms caused by CNS damage</td>
<td>Tinnitus and hyperacusis (increased sensitivity to sounds)</td>
</tr>
<tr>
<td>Acute expressive aphasia (transient)</td>
<td>Photosensitivity</td>
</tr>
<tr>
<td>Gait/balance problems caused by CNS damage</td>
<td>Reduced tolerance to alcohol or medications</td>
</tr>
</tbody>
</table>

Cognitive Deficits
Emotional Residuals
Physical Neurological Features
Neurological Signs and Symptoms

A mixture of documented neuro-cognitive deficits
Brain-based and or reactive emotional residua
Neurological signs and symptoms
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**Challenge 1**
Postconcussional symptoms are often examined by different disciplines:
- Physical symptoms by neurologists
- Emotional residuals by psychiatrist
- Cognitive profile by neuropsychologist

**DISCIPLINE VS. PATIENT-BASED PERSPECTIVE**
A discipline specific perspective is typically skewed

**Medical Model**

**Neuropsychological Model**
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MODEL DEVELOPED WITH MY PATIENTS

Pre-TBI issues clearly play a role
However, the available personality tests such (MMPI, MCMI) do not distinguish between pre-TBI and post-TBI symptoms

Challenge 2

Patient-based Perspective

MEANING IN LIFE

Work

Cognitive

Physical

Emotional

Social

Financial

Recreational

Rational for Developing a new Measure

- Develop a measure for individuals who have sustained a catastrophic illness
- Capture emotional, physical, cognitive and quality of life changes
- Replace discipline-specific focus with patient-oriented approach
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DEFICITS ARE UNDERSTOOD RELATIVE TO PREMORBID ABILITIES

Most concepts emerge in relationship to other concepts
Stinginess vs. Generosity
Moral vs. Immoral

(C.G. Jung)

RNBI assesses the patient’s perception of their premorbid and postmorbid functioning level

- Current Status
  - 4 Cognitive Scales
  - 6 Emotional Scales
  - 3 Physical Scales
  - 5 Quality of Life Scales

- Premorbid Status
  - 4 Cognitive Scales
  - 6 Emotional Scales
  - 3 Physical Scales
  - 5 Quality of Life Scales

Standardization of the RNBI

- Normative Sample N = 1024

- Patient Samples
  - Traumatic Brain Injury N = 52
  - Stroke N = 43
  - Chronic Pain N = 52
  - Spinal Cord Injury N = 37

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Summary
- Avoid discipline-specific bias
- Explore interactions among symptoms
- Diagnostic Framework should identify Current Problems Pre-injury Status

Summary
- Separate between
  - Brain-base mood changes
  - Brain-based personality disorder
  - Psychological reactions to the being brain damage
  - Pre-injury mood disorders
  - Pre-injury personality disorders