Treating Co-morbid PTSD and Traumatic Brain Injury When Cognitive Impairment is a Concern

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Associate Professor of Psychiatry,
UC San Diego School of Medicine
~20% of deployed Iraq/Afghanistan service members have experienced a TBI (Tanelian & Jaycox, 2008)
Criteria for Severity of TBI

(If a patient meets criteria in more than one category of severity, the higher severity level is assigned)

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structural imaging</td>
<td>Normal</td>
<td>Normal or abnormal</td>
<td>Normal or abnormal</td>
</tr>
<tr>
<td>Loss of Consciousness (LOC)</td>
<td>0-30 min</td>
<td>&gt;30 min and &lt;72 hours</td>
<td>&gt;24 hours</td>
</tr>
<tr>
<td>Alteration of consciousness/ mental state (AOC)*</td>
<td>up to 24 hours</td>
<td>&gt;24 hours; severity based on other criteria</td>
<td></td>
</tr>
<tr>
<td>Posttraumatic amnesia (PTA)</td>
<td>0-1 day</td>
<td>&gt;1 and &lt;7 days</td>
<td>&gt;7 days</td>
</tr>
<tr>
<td>Glasgow Coma Scale (GCS) (best available score in first 24 hours)**</td>
<td>13-15</td>
<td>9-12</td>
<td>&lt;9</td>
</tr>
</tbody>
</table>

*Alteration of mental status must be immediately related to the trauma to the head. Typical symptoms would be looking and feeling dazed and uncertain of what is happening, confusion, and difficulty thinking clearly or responding appropriately to mental status questions, and being unable to describe events immediately before or after the trauma event.

**In April 2015, the DoD released a memorandum recommending against the use of GCS scores to diagnose TBI. See the memorandum for additional information.[3]
Posttraumatic Stress Disorder

» 70% of U.S. Adults have experienced some form of trauma

» 11-23% of Iraq and Afghanistan Veterans have PTSD

Up to 20% will develop PTSD
Polytrauma Clinical Triad

Lew et al., 2009
Barring any intervening causes, the trajectory of recovery of cognitive symptoms is improvement or plateau.

In the majority of cases, cognitive symptoms of mild TBI resolve within 1 week.

In ~15% of cases, mTBI symptoms do not diminish as expected → persistent post-concussive syndrome (Belanger, Kretzmer, Vanderploeg, & French, 2009).

No consistent relationship between symptom complaints and objective findings on:
- Neuropsychological Testing
- Physical Examination
- Neurological Examination

Psychological factors likely play a large role in symptom persistence in persistent symptoms following mTBI.
Neuropsychology of PTSD

• Cognitive deficits associated with PTSD (Vasterling et al. 2002)
  • Attention
  • Learning and verbal memory
  • Working memory
  • Executive functions – inhibition, interference
    ▪ Deficits align with limbic and paralimbic regions – prefrontal regions subserving arousal regulation and inhibition
    ▪ PTSD is associated with longer lasting cognitive difficulties than mTBI (Vasterling et al., 2012).
    ▪ May also be associated with worsening cognition over time
    ▪ Those with PTSD are twice as likely to develop dementia than those without (Yaffe et al., 2010).
    ▪ With time and ongoing symptoms, neuronal systems in those with PTSD may become overresponsive, leading to worsening cognition over time.
      • Stress sensitization - stress leads to changes in neurotransmitter/neurohormonal responses, that can create or exacerbate PTSD symptoms
Persistent Postconcussive Symptoms

- Occur readily in healthy individuals with no history of concussion
- No symptom unique to only mild TBI
- Symptoms overlap with one or more other conditions

70-80% of healthy participants met DSM–IV (79.6%) or ICD-10 (72.1%) self-report criteria for Postconcussive Syndrome

Iverson & Lange, 2003
Veterans Presenting for Treatment of Cognitive Complaints

- Less than 30% of Veterans with a history of concussion had objective deficits upon formal testing
- ~85% had PTSD or other comorbid mental health concerns

(Jak et al., 2015)
Dynamic relationship between comorbid PTSD and history of mTBI

Fig. 1. Adapted from Vasterling, Bryant, and Keane (2012).
Evaluation of a hybrid treatment for Veterans with comorbid traumatic brain injury and posttraumatic stress disorder: Study protocol for a randomized controlled trial

Amy J. Jak, Robin Appels, Carlos S. Rodgers, Ariel J. Lang, Dawn M. Schiehser, Sonya B. Norman, Elizabeth W. Twamley

72 veterans with mTBI and PTSD (see Inclusion/Exclusion Criteria)

Random Assignment

36 CPT

Baseline Assessment:
PCL, WARCAT, NSI, BDI
Neuropsychological Functioning
QOLI

PCL, NSI, BDI
Neuropsychological Functioning
QOLI

36 SMART-CPT

3-month Assessment:
PCL, NSI, BDI
Neuropsychological Functioning
CSQ
QOLI

6-month Assessment:
PCL, NSI, BDI
Neuropsychological Functioning
QOLI

Weekly assessment of PTSD symptoms and treatment compliance, NSI at 6 weeks.
Interventions

• SMART-CPT: Incorporates TBI psychoeducation, compensatory strategies for attention, memory, and executive functioning, more concrete language, written and verbal repetition and reviews of key CPT points, and simplified and restructured homework pages into standard CPT.
  • 12 sessions, est. 75 minutes each (actual avg. 86 min.)
  • Veteran provided with manual with all in-session material, handouts, and homework

• CPT – strategies for challenging maladaptive thought processes related to trauma
  • 12 sessions, est. 60 minutes each (actual avg. 73 min)
  • Veteran provided with homework handouts
SMART-CPT Modifications

CogSMART strategies integrated into CPT:

- Active breaks
- Self-talk
- Calendar use – remember appts/homework & other important activities, organize time/priorities including to-do lists
- Home for important items
- Strategic reminders (notes/visual cues, alarms)
- Visual imagery
- Retrieval strategies
- Goal setting and planning
- Brain storming and problem solving
SMART-CPT Modifications

- Provide written copies of session agendas and session reviews
- Patient handouts include written summaries of key topics discussed orally in session
  » E.g., PTSD symptoms, fight/flight/freeze, just world belief, natural vs manufactured emotions, hindsight bias, self blame, five themes
- Color-coded A-B-C and challenging beliefs worksheets (CBWs) to clearly separate sections
- CBWs are also simplified
- More concrete language
- Repetition of key points
- Built-in breaks
<table>
<thead>
<tr>
<th></th>
<th>Total Sample (N=150)</th>
<th>CPT-C (N=49)</th>
<th>SMART-CPT (N=51)</th>
<th>t, χ², or F</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age, years</strong></td>
<td>34.39 (7.89)</td>
<td>33.94 (7.27)</td>
<td>34.82 (8.50)</td>
<td>-56 (98)</td>
<td>.278</td>
</tr>
<tr>
<td><strong>Education, years</strong></td>
<td>13.69 (1.83)</td>
<td>13.88 (1.55)</td>
<td>13.51 (1.98)</td>
<td>1.00 (98)</td>
<td>.317</td>
</tr>
<tr>
<td><strong>Male, %</strong></td>
<td>89.0%</td>
<td>87.8%</td>
<td>90.2%</td>
<td>χ² = .15 (1)</td>
<td>.758</td>
</tr>
<tr>
<td><strong>Non-Caucasian, %</strong></td>
<td>53%</td>
<td>50.2%</td>
<td>47.1%</td>
<td>χ² = .48 (1)</td>
<td>.155</td>
</tr>
<tr>
<td><strong>Loss of Consciousness, minutes</strong></td>
<td>4.50 (8.84)</td>
<td>5.49 (8.90)</td>
<td>3.61 (8.78)</td>
<td>1.95 (95)</td>
<td>.207</td>
</tr>
<tr>
<td><strong>Number of TBs</strong></td>
<td>2.81 (1.92)</td>
<td>2.90 (1.59)</td>
<td>2.73 (1.87)</td>
<td>44 (97)</td>
<td>.661</td>
</tr>
<tr>
<td><strong>Percentage Service Connection</strong></td>
<td>57.10 (38.70)</td>
<td>55.73 (37.88)</td>
<td>57.45 (39.84)</td>
<td>-53 (98)</td>
<td>.322</td>
</tr>
<tr>
<td><strong>Treatment</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Treatment Completion, %</strong></td>
<td>53.0%</td>
<td>40.0%</td>
<td>56.9%</td>
<td>χ² = 6.2 (1)</td>
<td>.011</td>
</tr>
<tr>
<td><strong>Prior PTSD Treatment, %</strong></td>
<td>57.0%</td>
<td>35.7%</td>
<td>58.8%</td>
<td>χ² = 7.1 (1)</td>
<td>.008</td>
</tr>
<tr>
<td><strong>Prior Cognitive Rehabilitation, %</strong></td>
<td>1.0%</td>
<td>1.0%</td>
<td>0%</td>
<td>χ² = 1.0 (1)</td>
<td>.315</td>
</tr>
<tr>
<td><strong>Total sessions completed</strong></td>
<td>7.96 (4.74)</td>
<td>7.37 (4.95)</td>
<td>8.53 (4.51)</td>
<td>-1.23 (96)</td>
<td>.222</td>
</tr>
<tr>
<td><strong>Average time per session, minutes</strong></td>
<td>78.77 (19.24)</td>
<td>72.65 (16.96)</td>
<td>86.03 (19.77)</td>
<td>-3.53 (90)</td>
<td>.001</td>
</tr>
<tr>
<td><strong>Symptom Severity</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>PCL-S</strong></td>
<td>59.35 (16.65)</td>
<td>61.06 (9.92)</td>
<td>57.63 (11.17)</td>
<td>61 (96)</td>
<td>.111</td>
</tr>
<tr>
<td><strong>NSI</strong></td>
<td>46.56 (14.12)</td>
<td>48.61 (14.92)</td>
<td>45.51 (13.10)</td>
<td>1.45 (96)</td>
<td>.151</td>
</tr>
<tr>
<td><strong>BDI-II</strong></td>
<td>27.68 (10.27)</td>
<td>27.29 (9.62)</td>
<td>28.06 (10.96)</td>
<td>22 (95)</td>
<td>.274</td>
</tr>
<tr>
<td><strong>Cognitive</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>WRAT Reading</strong></td>
<td>97.02 (10.93)</td>
<td>97.04 (10.63)</td>
<td>96.96 (9.44)</td>
<td>37 (95)</td>
<td>.603</td>
</tr>
<tr>
<td><strong>WAIS-1V Verbal IQ</strong></td>
<td>91.5 (13.21)</td>
<td>90.1 (15.18)</td>
<td>92.88 (10.93)</td>
<td>22 (94)</td>
<td>.629</td>
</tr>
<tr>
<td><strong>CVLT-II 1-5 Learning Total</strong></td>
<td>43.35 (9.72)</td>
<td>43.35 (9.72)</td>
<td>43.39 (9.83)</td>
<td>3.25 (95)</td>
<td>.075</td>
</tr>
<tr>
<td><strong>CVLT-II SDT</strong></td>
<td>-54 (9.46)</td>
<td>-67 (9.53)</td>
<td>-50 (9.48)</td>
<td>-55 (95)</td>
<td>.288</td>
</tr>
<tr>
<td><strong>CVLT-II DFR</strong></td>
<td>-69 (11.3)</td>
<td>-81 (10.7)</td>
<td>-75 (11.9)</td>
<td>-79 (95)</td>
<td>.236</td>
</tr>
<tr>
<td><strong>WAIS-1V Digit Span</strong></td>
<td>8.36 (2.55)</td>
<td>8.35 (2.53)</td>
<td>8.38 (2.67)</td>
<td>64 (96)</td>
<td>.426</td>
</tr>
<tr>
<td><strong>D-KEFS Trail-Making</strong></td>
<td>8.85 (2.78)</td>
<td>8.72 (2.77)</td>
<td>8.96 (2.81)</td>
<td>92 (94)</td>
<td>.879</td>
</tr>
<tr>
<td><strong>Number Letter Switching</strong></td>
<td>7.80 (4.04)</td>
<td>7.66 (4.45)</td>
<td>7.94 (3.65)</td>
<td>55 (93)</td>
<td>.829</td>
</tr>
<tr>
<td><strong>D-KEFS Color Word Inhibition</strong></td>
<td>48.08 (8.90)</td>
<td>48.06 (8.93)</td>
<td>48.10 (8.97)</td>
<td>84 (94)</td>
<td>.815</td>
</tr>
<tr>
<td><strong>TOMM 2 Total Errors</strong></td>
<td>47.45 (4.54)</td>
<td>46.69 (5.29)</td>
<td>48.18 (3.58)</td>
<td>1.65 (98)</td>
<td>.103</td>
</tr>
<tr>
<td><strong>TOMM Retention Trial</strong></td>
<td>46.80 (5.54)</td>
<td>45.94 (6.59)</td>
<td>47.63 (4.29)</td>
<td>-1.53 (98)</td>
<td>.128</td>
</tr>
<tr>
<td><strong>QOL-LB General Life Satisfaction</strong></td>
<td>4.07 (1.30)</td>
<td>4.19 (1.21)</td>
<td>3.96 (1.38)</td>
<td>85 (95)</td>
<td>.390</td>
</tr>
</tbody>
</table>
Change in Mental Health and Neurobehavioral Symptoms

- Statistically and clinically significant improvement in PTSD, depression, and postconcussive symptoms - No group differences
- Similarly, significant improvement in quality of life (general life satisfaction, daily activities, family, health), but no group differences
Change in Cognitive Functioning

Jak et al., 2019
Mild traumatic brain injury characteristics do not negatively influence cognitive processing therapy attendance or outcomes

Laura D. Crocker\textsuperscript{a,b,*}, Sarah M. Jurick\textsuperscript{b,c}, Kelsey R. Thomas\textsuperscript{d}, Amber V. Keller\textsuperscript{a}, Mark Sanderson-Cimino\textsuperscript{e}, Samantha N. Hoffman\textsuperscript{a}, Briana Boyd\textsuperscript{f}, Carie Rodgers\textsuperscript{g}, Sonya B. Norman\textsuperscript{b,d,h}, Ariel J. Lang\textsuperscript{b,d}, Elizabeth W. Twamley\textsuperscript{a,b,d}, Amy J. Jak\textsuperscript{b,c,d}

• Injury variables do not moderate treatment response
• History of mTBI should not preclude individuals from receiving CPT, regardless of injury characteristics.
Veterans Presenting for Treatment of Cognitive Complaints

- Less than 30% of Veterans with a history of concussion had objective deficits upon formal testing
- ~85% had PTSD or other comorbid mental health concerns

Jak et al., 2015
Performance Validity

Both PVT groups experienced improved psychological symptoms following treatment.

Jurick et al., accepted for publication

Figure 1. Graphical depictions of the MLM results predicting symptom change. Gray shading represents 95% confidence intervals. A) PCL-S = Posttraumatic Stress Disorder Checklist – Specific Trauma, B) NSI = Neurobehavioral Symptom Inventory, C) BDI-II = Beck Depression Inventory - Second Edition.
Veterans who failed PVTs at baseline demonstrated better test engagement following treatment, resulting in higher rates of valid PVTs at follow-up.
Importance of Executive Functioning

- Examined whether baseline measures of EF were associated with treatment attendance/drop-out and response in SMART-CPT data
  - Working memory: WAIS-IV Digit Span Sequencing
  - Cognitive flexibility: D-KEFS Trail Making Test number-letter switching condition
  - Inhibition: D-KEFS Color Word Interference Test inhibition condition
  - Inhibition/cognitive flexibility: D-KEFS Color Word Interference Test inhibition/switching condition
  - Novel problem solving: Wisconsin Card Sorting Task
- Only included individuals who passed effort measures at baseline (n = 74)

Crocker et al., 2018
Those who dropped out of treatment had worse executive functioning at baseline relative to those who completed treatment.

Measures of memory did not predict CPT response – results were specific to EF.
Executive Function and CPT Response

- Baseline measures of EF predicted change in PTSD symptoms
- Worse performance on multiple executive function tests at baseline was associated with poorer response to CPT
Executive Function and CPT Response

Three-way interaction indicating that individuals with worse baseline cognitive flexibility did not benefit as much from standard CPT but demonstrated significant PTSD symptom improvement in the SMART-CPT condition, comparable to those with better baseline cognitive flexibility.
Treatment Recommendations

- VA/DoD guidelines state that co-occurring disorders should not prevent Veterans from receiving empirically supported treatments for PTSD and in fact assert that treatment of mood and pain are first line treatments.

- Research supports this guideline - history of TBI should not preclude trauma-focused therapies (Ragsdale & Horrell, 2016; Walter et al., 2014; Davis et al., 2013)
Summary

- Both CPT and SMART-CPT resulted in clinically significant reductions in PTSD and post-concussive symptomatology as well as improvements in quality of life.
- Adding compensatory cognitive strategies to mental health treatment does provide differential benefit in the cognitive domains of attention, learning/memory, and novel problem solving.
- Targeting executive functioning skills may be particularly important for both treatment retention and symptom reduction.
- Veterans with invalid neuropsychological testing should be enrolled in trauma-focused treatment, and may benefit from neuropsychological assessment after, rather than before, treatment.
- Individuals with a history of concussion and persistent post-concussive symptoms can successfully complete structured and empirically supported mental health therapies with or without modifications.
Thank you!

- amy.jak@va.gov
Please enter your questions in the Q&A box and be sure to include your email address.

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   - Register in TMS.

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   - Search “My Learning” to find it.

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   - Print certificate from “My History” section of TMS.
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**SAVE THE DATE:** Third Wednesday of the Month from 2-3PM (ET)

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<tr>
<th>Date</th>
<th>Topic</th>
<th>Speaker</th>
</tr>
</thead>
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<tr>
<td>October 16</td>
<td>Unconventional Interventions for PTSD: State of the Evidence</td>
<td>Paul Holtzheimer, MD</td>
</tr>
<tr>
<td>November 20</td>
<td>Addressing Sleep: A Strategy for Symptom Reduction &amp; Suicide Prevention?</td>
<td>Wilfred Pigeon, PhD</td>
</tr>
<tr>
<td>December 18</td>
<td>Treating Comorbid PTSD and Borderline Personality Disorder</td>
<td>Melanie Harned, PhD, ABPP</td>
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<tr>
<td>January 15</td>
<td>Dissociation, Somatization, and Other Challenging Presentations of PTSD</td>
<td>Abigail Angkaw, PhD</td>
</tr>
<tr>
<td>February 19</td>
<td>Concurrent Treatment of PTSD and SUDs using Prolonged Exposure (COPE)</td>
<td>Sudie Back, PhD</td>
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</tbody>
</table>

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