Why Bother?
Using the Cognitive Neuroscience of Reward to Inform Psychosocial Treatments for Anhedonia

Moria Smoski, PhD
June 8, 2017
Overview

• Definition of Anhedonia
• Components of Reward Processing
• How Behavioral Activation Targets Anhedonia
• Neural Reward Processing and BA
Anhedonia

Melancholy, Edvard Munch
Clinical Relevance of Anhedonia

- Associated with chronicity, treatment resistance, and relapse risk
- Moderates treatment response

Figure 2

Dimensions of depressive symptoms and smoking cessation

Adam M. Leventhal, Susan E. Ramsey, Richard A. Brown, Heather R. LaChance, Christopher W. Kahler
Anhedonia in DSM-5

- MDD: Markedly diminished interest or pleasure in all, or almost all, activities most of the day, nearly every day
- Schizophrenia: diminished emotional expression or avolition
- PTSD: Persistent inability to experience positive emotions
- SUD: Important social, occupational, or recreational activities are given up or reduced due to substance use

Lack of **motivation, interest, and/or pleasure** in everyday activities, resulting in a **reduction in goal-directed behavior**
Components of Reward

- Reward Anticipation
- Consummatory Responding

Reward learning
Pathways of Reward
Reward Network Alteration in MDD

• Reduced ventral striatal activation to positive stimuli (e.g., Keedwell et al., 2005, Epstein et al., 2006)

• Altered vmPFC activation to positive stimuli (increased in Keedwell et al., 2005; decreased in Epstein et al., 2006, Mitterschiffthaler et al., 2003)

• Failure to sustain positive affect and associated NAcc activation over time (Heller et al., 2009)
Reward Network Alteration in MDD

Research report
fMRI of alterations in reward selection, anticipation, and feedback in major depressive disorder

Moria J. Smoski, Jennifer Felder, Joshua Bizzell, Steven R. Green, Monique Ernst, Thomas R. Lynch, Gabriel S. Dichter

Journal of Affective Disorders

Journal homepage: www.elsevier.com/locate/jad
Treatment of Anhedonia

• Pharmacotherapy
  – Antidepressants
  – Kappa opioid receptor antagonists

• Neurostimulation
  – ECT
  – TMS

Anhedonia and Reward-Circuit Connectivity Distinguish Nonresponders from Responders to Dorsomedial Prefrontal Repetitive Transcranial Magnetic Stimulation in Major Depression
Behavioral Activation

- Structured, brief psychosocial approach
- Based on premise that problems in vulnerable individuals' lives and behavioral responses reduce ability to experience positive reward from their environments
- Aims to systematically increase activation such that patients may experience greater contact with sources of reward in their lives and solve life problems
- Focuses directly on activation and on processes that inhibit activation, such as avoidance behaviors and ruminative thinking

A brief history of a brief behavioral treatment for MDD

1970s
- Lewinsohn: Increase positive events to decrease depression
- Ferster: Functional analysis of depression; Importance of avoidance

1980s
- Beck: Use of behavioral activation as a tool to modify cognitive beliefs

1990s
- Jacobson: Component analysis of CBT: the B wins
Cognitive Therapy for Depression

- Automatic Thought Strategies
- Facilitative Strategies
- Behavioral Activation Strategies
- Core Belief Strategies
Component Analysis of Cognitive Therapy

Behavioral Activation  Vs.  Full CT Package

Table 3
Mean Pretreatment, Posttreatment, and 6-Month Follow-Up Scores for BDI and HRSD for Four Samples of Participants in Each Treatment Condition

<table>
<thead>
<tr>
<th>Depression and measure</th>
<th>BA</th>
<th>AT</th>
<th>CT</th>
<th>F (df) and p</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>n</td>
<td>M(SD)</td>
<td>n</td>
<td>M(SD)</td>
</tr>
<tr>
<td>Total sample (n = 149)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>BDI</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>56</td>
<td>29.3 (6.6)</td>
<td>43</td>
<td>29.1 (6.6)</td>
</tr>
<tr>
<td>Post</td>
<td>56</td>
<td>9.1 (7.9)</td>
<td>43</td>
<td>10.6 (9.3)</td>
</tr>
<tr>
<td>6 months</td>
<td>50</td>
<td>8.5 (7.6)</td>
<td>39</td>
<td>9.3 (8.2)</td>
</tr>
<tr>
<td>HRSD</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pre</td>
<td>56</td>
<td>17.4 (3.9)</td>
<td>43</td>
<td>19.1 (3.9)</td>
</tr>
<tr>
<td>Post*</td>
<td>53</td>
<td>6.4 (4.6)</td>
<td>40</td>
<td>6.9 (5.8)</td>
</tr>
<tr>
<td>6 months</td>
<td>50</td>
<td>6.6 (4.8)</td>
<td>39</td>
<td>7.7 (6.1)</td>
</tr>
</tbody>
</table>
Figure 2. Cumulative proportion of treatment responders who survived without relapse over the 2 years of follow-up (the vertical line indicates the point at which patients on continuation medication were withdrawn from medication). BA = behavioral activation; CT = cognitive therapy.
Figure 2. BDI and HRSD slope trajectories for active treatments during the full acute phase. BDI = Beck Depression Inventory; HRSD = Hamilton Rating Scale for Depression; CT = cognitive therapy; BA = behavioral activation; ADM = antidepressant medication.
BA Course of Treatment

• Activity Monitoring
• Values Assessment
• Identification of Goals
• Implementation of Goals
  – Troubleshooting
  – Reduction of avoidance
  – Continued monitoring
  – Development of self-reinforcing behaviors
BA for Anhedonia: Approach
Motivation

• Formal values assessment
• Identification of activities that are maximally likely to be perceived as important and/or enjoyable
• Graded task assignment to manage effort valuation
BA: Values (or, “Why Bother?”)

• Definition: Desired qualities of behavior – what sort of person do we want to be?
• In the absence of strong past reward learning, can provide guiding principles to decide how to spend one’s time (combats “directionlessness”)
• Suggests a range of behaviors rather than a single goal
Actions Support Values

- Charitable donations
- Listening to friends
- Giving spouse the last cookie
- Volunteer work

Generosity
BA for Anhedonia: Consummatory Responding

• Structured monitoring of actual (vs. anticipated) responses to behaviors
• Inclusion of both enjoyment and perceived importance as feedback
• Targeting of experiential avoidance
• Savoring
BA for Anhedonia:
Reward-Based Learning

• Increased conscious choice of activities
• Feedback loop of anticipated versus actual enjoyment/importance
• Reduction in non-rewarding activities as well as increase in potentially rewarding activities
Reward Network Activation Changes with BA
...And Predicts Treatment Response

Resting-State Connectivity Predictors of Response to Psychotherapy in Major Depressive Disorder

Andrew Crowther, Maria J Smoski, Jared Minkel, Tyler Moore, Devin Gibbs, Chris Petty, Josh Bizzell, Crystal Edler Schiller, John Sideris, Hannah Cart and Gabriel S Dichter
Sustained Connectivity

Greater attenuation of connectivity between left NAcc and paracingulate gyrus during reward outcome predicted greater reductions in depression symptoms with treatment.
More Anhedonia = Better Response to BA

Reaction Time to Rewarded Trials

Baseline Anhedonia Symptoms

- Less RT change from run 1 to run 2
- Greater RT change from run 1 to run 2
Limitations

• Open trials: Specific to BA?
• Sample: Specific to MDD?
• Mechanism: What changes first, symptoms or neural activation/connectivity?
BATA Trial

- RCT comparing Behavioral Activation to MBCT
- Transdiagnostic sample recruited based on anhedonia severity
- 15 week treatment with imaging at baseline, 8, 12, and 16 weeks
- Experimental Therapeutics approach
- Recruiting soon!
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