Deficient Emotional Self-Regulation is a Core Component of ADHD: Evidence and Treatment Implications

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Sources:

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What is ADHD?
The Current Clinical View

A disorder of age-inappropriate behavior:

**Inattention** (Working Memory) – The “Cool” Executive Functions
- At least 6 types of attention – not all are impaired in ADHD
  - Arousal, alertness, selective, divided, span of apprehension, & persistence
- Poor persistence toward goals or tasks
- Impaired resistance to responding to distractions
- Deficient task re-engagement following disruptions
- Impaired working memory (remembering so as to do)

More on ADHD
The Current Clinical View

A disorder of age-inappropriate behavior:

**Hyperactivity-Impulsivity** (Inhibition – EF)
- Impaired verbal and motor inhibition
- Impulsive decision making; cannot wait or defer gratification
- Greater disregard of future (delayed) consequences
- Excessive task-irrelevant movement and verbal behavior
  - Fidgeting, squirming, running, climbing, touching
- Restlessness decreases with age, becoming more internal, subjective by adulthood

- Emotional impulsiveness and deficient emotional self-regulation?????
  - Impatient, low frustration tolerance, hot-tempered, quick to anger, touchy or easily annoyed, over-react, easily excited
ADHD is a Disorder of Executive Functioning

EF Consists of Two Major Components

**Inhibition:**
- Cognitive, Verbal, Motor, & Emotional

**Self-Regulation**
- Working Memory, Planning/Problem Solving (& Emotional Self-Regulation)

ADHD
- Hyperactivity
- Impulsivity

ADHD
- Inattention

What is an Emotion?

- A relatively short-duration change in our intentional state that entrains changes in behavior, cognition, physiological arousal, and motivation

- Emotions usually comprise 3 dimensions:
  - Approach – withdrawal actions & cognitions
    - Opportunity vs. threat (excitement vs. apprehension)
  - Reinforcement – punishment motivations
    - Desire vs. fear, contentment vs. frustration
  - Physiological activation (intensity of reaction)

- Emotions serve a communicative function not just an expressive or cathartic one

What is Emotional Self-Regulation?

1. Ability to inhibit inappropriate behavior related to strong negative or positive emotion
2. Self-soothe any physiological arousal related to #1 above
3. Refocus attention from the emotionally provocative events
4. Organize emotions for coordinated action in the service of goals and long-term welfare


Deficits in Emotional Self-Regulation (DESR)

- Emotional impulsiveness – part of the Inhibition Deficit
  - Poor inhibition of inappropriate behavior related to strong emotions
  - Low frustration tolerance, impatient
  - Quick to anger, hot tempered, easily annoyed
  - Greater emotional excitability and reactivity
- Difficulties self-regulating (moderating) emotional reactions to evocative events
  - Deficient in effortful, cognitive “top-down” regulation of induced emotions (self-soothing, refocusing attention)
  - Difficulties inducing positive, more acceptable mood states
- Impaired self-motivation and activation (arousal) when needed to support goal-directed action

Why Make DESR a Core Feature of ADHD?

170 Years of Historical Inclusion

- 1798 – Alexander Crichton includes emotional frustration as part of disorders of attention persistence in first medical paper on attention disorders
- 1902 – George Still includes emotional impulsiveness and poor regulation of emotions by "moral control" in his conceptualizations of defective moral control of behavior (historical precursor to ADHD)
- 1960s – Clinical researchers repeatedly include symptoms of DESR in their concepts of MBD and the hyperactive child syndrome
- 1970 – Mark Stewart includes low frustration tolerance, quickness to anger, and emotional excitability in his description of the hyperactive child syndrome
- 1975 – Dennis Cantwell includes poor emotion regulation as a core feature of the hyperactive child syndrome
- 1971 & 76 – Paul Wender makes poor emotional control a key feature of his work on MBD in children and adults
- 1968 – DSM-II fails to note DESR as a feature of ADHD and it stays out of DSMs since that time
DESR is Included in Current Neuropsychological Theories of ADHD

Emotion Regulation is A Major Component in Barkley’s EF Theory of ADHD

- Start with a theory of normal development of inhibition, self-regulation, and executive functioning
- Inhibition comprises three related processes:
  - Inhibiting the prepotent or dominant response (emotions included)
  - Interrupting ongoing behavior
  - Interference control: Protecting the EFs from distraction
- Self-regulation can be defined as:
  - Any action a person directs toward one’s self
  - So as to change their own behavior
  - In order to change the likelihood of a future consequence
- An executive function can be defined as:
  - a major type of action-to-the-self (a type of self-regulation)
- The major purpose of the EFs is the cross-temporal organization of behavior to attain goals and maximize long term gains (future welfare)
More on the EF Theory

- There are 4 other EFs besides inhibition:
  - Nonverbal and verbal working memory
  - Emotional inhibition and self-regulation
  - Planning and problem-solving
- They can be redefined as actions-to-the-self:
  - Sensing to the self (visual imagery & re-hearing)
  - Speech to the self
  - Emotion and motivation to the self
  - Play to the self
- Each likely develops by behavior being turned on the self and then internalized (privatized)
- They develop in a step-wise hierarchy - Each needs the earlier ones to function well

Linkage of EFs to daily life activities

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Theories of the Neural Networks for ADHD
All Include Emotional Dysregulation

- The frontal-striatal circuit: Associated with deficits in response suppression, freedom from distraction, working memory, organization, and planning, known as the “cool” or “what” EF network

- The frontal-cerebellar circuit: Associated with motor coordination deficits, and problems with the timing and timeliness of behavior, known as the “when” EF network

- The frontal-limbic circuit: Associated with symptoms of emotional dyscontrol, motivation deficits, hyperactivity-impulsivity, and proneness to aggression, known as the “hot” or “why” EF network


DESR would be anticipated from neuro-imaging findings

Smaller, Less Active, Less Developed Brain Regions

- 3-10% reduced regional volumes in these 5 regions:
  - Orbital-Prefrontal Cortex (primarily right side)
    - Genetics contributes to under-development of this region while acquired ADHD may be related to smaller inferior dorsolateral frontal region
  - Basal Ganglia (mainly striatum & globus pallidus)
  - Cerebellum (central vermis area, more on right side)
  - Anterior cingulate cortex (mostly shows under-activity)
  - Corpus callosum – forward aspect or splenium

- Size of this network is correlated with degree of ADHD symptoms, particularly inhibition

- No gender differences

- 2-3 year lag in brain development but achieving typical brain volumes by age 16

- Results are not due to taking stimulant medication
Anterior-posterior (rostral-caudal) hierarchy of cognitive control of behavior

Figure 1. Schematic of major anatomical sub-divisions in the frontal lobes. Boundaries and Brodmann areas (BA) are only approximative. Arrows indicate anatomical directions of anterior/rostral (front) versus posterior/caudal (back) and dorsal (up) versus ventral (down). From caudal to rostral, labeled areas include motor cortex, dorsal (PMd) and ventral premotor cortex, dorsal (pre-PMd) and ventral aspects of anterior premotor cortex, ventro- (VLPFC) and dorsolateral PFC (DLPFC), and lateral frontal polar cortex (FPC). Badre, D. (2008). Trends in Cognitive Sciences, 12(8), 193-200.
Cognitive vs Emotional functioning in the ACC


Role of the ACC in down-regulating the amygdala

Figure 7. Previous-Trial Incongruency Increases Negative Effective Connectivity from the Rostral Cingulate to the Amygdala. Coupling coefficients for directional intrinsic connectivity are shown as values next to the arrows between the rACC and the amygdala, while coefficients for the modulatory (bilinear) effects are shown as values associated with additional lines intersecting with the intrinsic paths. The only significant effect in the model was greater negative modulation of the rACC to amygdala path by previous-trial incongruency, which triggers greater current-trial conflict resolution (p = 0.02). Etkin, A. et al. (2006). *Neuron*, 57, 871-882.
DESR is Evident in Psychological Research on ADHD

- Research on child behavior rating scales shows elevations on subscales reflecting low frustration tolerance, anger, and emotional excitability (BRIEF, etc.)

- Direct observation studies of emotional control during emotional eliciting events shows poor inhibition of emotions and low frustration tolerance

- Follow-up studies of ADHD children into adulthood and studies of adults with ADHD show substantial DESR symptoms in the majority

Emotional Impulsivity in Adults with ADHD

Emotional Impulsivity in ADHD children followed to adulthood

ADHD-P = Persistent ADHD, ADHD-NP = Nonpersistent ADHD

DESR explains the linkage of ADHD to high risk for ODD
Oppositional Defiant Disorder

- A pattern of hostility, anger, defiance, stubbornness, low frustration tolerance and resistance to authority (usually parental)
- Occurs in 30-80% of ADHD cases
- ADHD cases have 11x greater risk for ODD* and may develop it within 2 yrs of ADHD onset
- All of the genetic contribution to ODD and CD is shared with (same genes as) that of ADHD**
- ODD has a two-dimensional structure***
  - Emotional Dysregulation
  - Social Conflict (and Situational Context)


Linking ADHD to ODD

Emotional Impulsiveness is the shared initial connection between ADHD and ODD

ADHD
- Impulsive Emotions:
  - Impatient
  - Easily Frustrated
  - Hot-tempered
  - Quick to Anger
  - Easily Annoyed
  - Excitable
- Inattention
- Hyperactivity
- Impulsivity

ODD
- Emotional:
  - Easily Frustrated
  - Hot-tempered
  - Quick to Anger
  - Easily Annoyed
- Social:
  - Defy/Refuse
  - Argue
  - Annoy Others
  - Blame Others
  - Spiteful
More on ODD

- ADHD causes ODD
  - This happens through the hyperactive-impulsive dimension of ADHD which includes emotional impulsiveness (EI)*
  - EI creates the first component of ODD

- But ODD also has a learned component (social conflict) due to disrupted parenting
  - Inconsistent, indiscriminate, emotional, and episodically vacillating between harsh and permissive (lax) consequences teaches social coercion as a means of social interaction
  - Poor parenting can partly arise from parental ADHD and other high risk parental disorders in ADHD families (e.g., depression, ASP, SUDS)


More on Link of ADHD to ODD

- Emotional dysregulation component predicts later MDD and anxiety disorders
- Social conflict component predicts later Conduct Disorder
- The causal linkage of ADHD to ODD can account for the well-established findings that ADHD medications reduce ODD symptoms nearly as much as they do ADHD symptoms
4-Factor Model of Defiance

Parental Psychopathology (ADHD, Depression, & SUDS) → Disrupted Parenting → Child defiance and social aggression

Family Stressors

Child ADHD & Negative Temperament

DESR Predicts Various Domains of Child Impairment

- DESR is best predictor of social rejection in children with ADHD
- DESR is related to educational risks
  - Less education
  - Need for special education,
  - Truancy and suspensions
- DESR in child (& full ODD) is predictor of greater parenting stress and family conflict
DESR & Adult Impairment

- DESR predicts driving: road rage, speeding, crashes, and DUI citations during driving in adults with ADHD
- DESR predicts number of job dismissals (being fired), periods of unemployment, and workplace behavior problems in occupational history
- DESR predicts marital dissatisfaction and likely dating/cohabiting relationship conflict
- DESR in adult with ADHD predicts risk for hyperactivity-impulsivity, ODD, and CD symptoms in offspring

Factors Contributing to Emotional Adjustment in ADHD

Core ADHD Symptoms:
- Emotional Impulsivity
- Deficient Self-Regulation of Emotions

Secondary Effects of ADHD-related Failures:
- School
- Peers
- Family
- Work
- Other Domains

Comorbid Emotional Disorders:
- Anxiety
- Dysthymia
- Depression
- Suicidality
- Bipolar

Secondary Effects of Comorbid Disorders:
- LDs
- ODD
- CD & SUDS
- OCD
- Tics & TS
- Sleep Problems

Impact of Social Ecology:
- Parenting
- Parent Disorders
- Family Stressors
- Traumatic Events
- Deviant Peers
- School
- Poverty
Diagnostic & Treatment Implications

- Don’t mistake emotional impulsivity (EI) and deficient emotional self-regulation (DESR) as being the result of comorbidity or reactions to previous failure experiences - they are central to ADHD itself.
- Core EI-DESR symptoms are improved by ADHD meds — drug types will differ in effects.
- Secondary consequences of ADHD and DESR on major life activities may also be improved by ADHD treatments:
  - Behavior at home, in school, and in community settings
  - Reactions of parents to child behavior
  - School productivity, teacher reactions, and the likelihood of school disciplinary actions
  - Peer interactions and social acceptability
  - Improved marital-cohabiting relationships
  - Sports participation, driving performance
  - Improved occupational functioning

More Implications

- Don’t mistake mood disorders as arising from EI-DESR
  - EI-DESR is a “top-down” deficit in regulating rational emotional responses to events probably via the L-PFC and ACC; mood disorders are “bottom-up” excessive expressions of emotions and probably of underlying amygdala-limbic system activities.
- Comorbid mood and other disorders may require separate management methods targeting them directly.
- But comorbid ODD may improve with ADHD meds given that 4 of its 8 symptoms are related to EI-DESR
  - Residual ODD may require behavioral parent training.
- Social ecology factors will require separate psychosocial interventions and possibly family relocation:
  - Some factors may be secondary to parental ADHD and related disorders making their identification and management essential to treating their ADHD child.
Conclusions

- ADHD contains an inherent core deficit in emotional impulsiveness and deficient emotional self-regulation
- This is consistent with the history, neuroanatomy, and neuropsychology of ADHD
- This can explain the linkage of ADHD to ODD and likely to other comorbid disorders
- The EI/DESR component of ADHD contributes to the social and emotional impairments seen in ADHD
- This component can contribute to emotional maladjustment along with the effects of:
  - Secondary ADHD-related failure experiences
  - Comorbid mood and anxiety disorders
  - Secondary effects of other comorbid disorders
  - Direct and indirect impact of adverse social ecological factors

Conclusions

- DESR contributes to impaired social relationships (family, peers, community)
- Link of ADHD to ODD increases risk for CD, antisocial behavior, and substance use and abuse
- Understanding the DESR component of ADHD explains the reductions in ODD resulting from ADHD medications
- Understanding the sources of emotional and social maladjustment provides a rationale for psychosocial interventions
Objectives

- Discuss the important role of emotional impulsiveness and deficient emotional self-regulation in the core symptoms of ADHD
- Review the factors that contribute to emotional adjustment in ADHD children and adolescents
- Summarize the results of research on the impact of poor emotion regulation in ADHD on various domains of functioning in children followed to adulthood
- Discuss implications of these outcomes for treatment planning