Emotional Processing: Assessment, Treatment and Research
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No Disclosures to Report

Outline
• What is Emotional Processing?
• How is Emotional Processing assessed in research?
• Emotional Processing after brain injury
• Using Neuroimaging in evaluating Emotional Processing
• Intervention for improving Emotional Processing
• Future Directions and Conclusions

Emotional Communication
• Expressive
  – Express or communicate your own emotional states to others
• Receptive
  – Comprehend or understand others’ emotional expression

Emotions
• Behaviors
• Voice/tone
• Body language/posture
• Facial affect
Emotional Processing

- Although emotions can be communicated through various ways, facial expression is the most common method of communication.
- Facial stimuli is most often used in research.

Basic Emotions

Why is studying Emotional Processing important?

- Following brain injury, individuals often experience:
  - shrinking social network
  - reduced employment
  - reduced social activities
  - increased likelihood of depression
  - difficulty with family relationships
  - loneliness
  - reduced quality of life
- Emotional processing is an essential component of successful interpersonal relationships.

Why is studying Emotional Processing important?

- Failure to accurately perceive other’s emotions could lead to:
  - misinterpreting other’s emotions
  - inappropriate responding
  - difficulty in maintaining social relationships
- Understanding the impact of emotional processing deficits is important to develop appropriate treatments.

Emotion Processing in Brain Injury: What we know

- Emotion processing difficulties occur in up to 39% individuals with moderate-severe TBI
- Impairments are likely due to damage resulting from brain injury itself rather than other factors (i.e., depression or anxiety)
- The inability to correctly perceive other’s emotions has been associated with impaired social functioning following TBI.
How Do We Assess Emotional Processing?

Angry

Happy
Sad

Different

Same

Emotional Processing in TBI

Identification
Angry  Happy  Sad
Surprise  Disgust  Fear

Discrimination
Same or Different?
Individuals with TBI had significantly fewer correct responses than HC on identification (p=.001) and discrimination (p=.04), demonstrating impairments in emotional processing.

Performance of TBI on the emotional processing task also significantly correlated with executive measures assessing organizational strategies, initiation, and abstraction.

Current Work: Measuring Emotional Processing

- Funded by the NJ Brain Injury Commission
- Evaluate the neural network underlying emotional processing in TBI
- fMRI study- imaging during a task of processing emotional faces

Current Work: Imaging Emotional Processing

Brain Areas Important for Emotional Processing

NeuroImaging to Examine Emotional Processing
Same or Different

Results
Results

TBI > HC
HC > TBI

Results

Fatigue
Attention

Caudate, Anterior Cingulate
Fusiform Gyrus
Visual Area for Faces

NeuroImaging of Emotional Processing

- There are differences between TBI and HCs in terms of processing of emotional faces
- TBI’s show increased activation of fatigue/motor related areas, as well as areas involved in attention
- TBI’s show reduced activation in the fusiform gyrus

NeuroImaging of Emotional Processing

- Brain activation differences between groups may account for impairments on processing of emotional faces
- Neuroimaging gives us additional understanding of why deficits occur in TBI
- Neuroimaging can also be used as a tool to examine treatment efficacy

Treating Emotional Processing

- Treatments for Emotional Processing have been used primarily in schizophrenia and autism
- In TBI, treatments are not specific to emotional processing issues, but are often done as part of "social skills" training
- At KF, we have begun to utilize treatments used in schizophrenia and autism for improving emotional processing in TBI
Treating Emotional Processing

• 12 session intervention to improve emotional processing
  1. Computerized training program to identify facial features
  2. Increase awareness of own emotion-generating stories from own life
  3. Increase awareness of own facial expression- use mimicry and mirror

Part 1: Training Facial Affect Recognition using the TAR

• TAR- Test of Affect Recognition

• Developed in Germany, used in schizophrenia

• Task: Introduce pictures of faces portraying different emotions

• Goal: Teach relevant facial features

  • Attend to relevant features
  • Recognize characteristics of features
  • Associate feature characteristics with appropriate emotions

Part 1- TAR

• Computerized program with emotional faces vary in gender, race, emotional intensity

• Obvious facial expression → subtle

• Visual cue used to highlight facial feature gradually vanishing

• Feedback provided for each trial
  – Eyes are wide open, mouth is slack. This person is fearful

• Criterion level of success to move on (80-85%)

• Comprise 2/3 training

• Option break down facial parts and train on those (pre-training, incorporated)

Part 2. Increasing awareness- stories

• Increase awareness of own internal emotions

• Last 4 sessions

• Generate short stories of emotional events

• Through questions focus on 2 strategies

  1. Attend to contextual cues of emotional features

     • Characters wants, expectations, behavior

  2. Relating story to other events in their lives

Part 3. Increasing awareness- mimicry

• Increase awareness of own internal emotions

• Last 4 sessions

  1. describing the physical and psychological changes in body associated with each emotion

     • Ex: sad- heaviness in chest, arms, legs, tightness in throat, eyes

  2. mimic each of 6 emotions

     • Using a mirror mimic each emotion

     • Feedback from mirror and examiner

Preliminary Findings
Changes after intervention

- Significant improvements on measure of facial affect

Baseline vs. Follow-up

Participant 1 vs. Participant 2

Summary

- Our preliminary data show that emotional processing deficits can be treated in individuals with TBI
- Interventions focused on mimicry and awareness of facial features may be useful in treating emotional processing
- Imaging can help us understand how treatments to improve emotional processing might also change brain activation

Other Types of Emotional Processing

Theory of Mind (ToM)

- Theory of mind (often abbreviated "ToM") is the ability:
  - to attribute mental states—beliefs, intents, desires, knowledge, etc.—to oneself and others
  - to understand that others have beliefs, desires, and intentions that are different from one's own.
Theory of Mind (ToM)

- Faux Pas
  - Understanding intentionality/lack of intentionality behind a statement
  - Impaired in TBI
    - Bibby & McDonald, 2005
    - Milders et al., 2008

Affective ToM

- "Reading the Mind in the Eyes"
  - Non-verbal ToM task
  - Developed by Simon Baron Cohen
  - Often impaired in Autism
  - Impaired in TBI
    - Geraci et al., 2010
    - Henry et al., 2006
    - Turkstra et al., 2004

- Terrified
- Annoyed
- Hostile
- Arrogant
- Upset
- Horrified
- Preoccupied
Who has impairment and who does not?

• Multiple Variables:
  – Location of injury
  – Length of time since injury
  – Premorbid IQ
  – Gender

Brain Areas Important for Emotional Processing

PFC Damage

• Deficits in ToM
  – Ability to infer mental states of others
  – Detection of deception
  – Performance on false-belief tasks

• Location of Injury/Pathology may determine type of deficit
  – Faux Pas
    • Left ventromedial PFC lesions = worse on Faux Pas compared to Right

Leopold et al., 2012
What about connections between regions?

- Studying location of injury is difficult in TBI because of Diffuse Axonal Injury (DAI) (aka Traumatic Axonal Injury)

Diffusion Tensor Imaging

Location of Injury/Pathology

- At KF, we examined WHERE in the brain pathology correlates with facial affect recognition impairments
- 42 mod-severe TBI/23 HCs
- Both groups performed the Facial Emotion Identification Task (FEIT)
- All subjects also underwent Diffusion Tensor Imaging (DTI)
- Correlational Analyses were run to find where in brain: reduced white matter integrity correlated with poor performance on the task.

Results

- TBIs worse on Facial Affect Recognition Task
- But did their performance correlate with damage to any location in the brain?
Inferior Longitudinal Fasciculus (ILF): connecting the occipital and anterior temporal lobes, passes through amygdala

Inferior fronto-occipital fasciculus (IFOF): connecting the occipital cortex to the PFC

Who has impairment and who does not?

- Multiple Variables:
  - Location of injury
  - Length of time since injury
  - Premorbid IQ
  - Gender

Length of time since injury

- Do emotional processing deficits exist in acute and chronic stages?
  - Yes, emotional processing deficits exist in groups of TBI in both acute and chronic
    - Impairments exist immediately following injury and 1 year later (Letswaart et al., 2008; Milders et al., 2006)
- Do emotional processing deficits worsen over time?
  - This has not been examined

Model of Emotional Processing Issues

Emotional Processing Problems

Shrinking Social Network

Interpersonal Issues

Who has impairment and who does not?

- Multiple Variables:
  - Location of injury
  - Length of time since injury
  - Premorbid IQ
  - Gender

Premorbid IQ

- We found a significant association between premorbid intelligence and facial affect FEIT identification (R = .319, p = .039)
- Cognitive Reserve?

Genova et al., 2014 Social Neuroscience
Who has impairment and who does not?

• Multiple Variables:
  – Location of injury
  – Length of time since injury
  – Premorbid IQ
  – Gender

Gender

• Recently we found that females with TBI perform better than males on tasks of facial affect recognition in terms of both accuracy ($t(45)=-2.67, p = .011$) and reaction time ($t(28)=2.17, p = .039$).
• Research in Autism suggests that “typical” females are better at performing certain emotional processing tasks than “typical” males.

Summary

• A significant number of individuals with TBI have emotional processing impairments
• Emotional Processing Impairments can be seen in:
  – Facial Affect Recognition
  – Theory of Mind
    • False Belief
    • Faux Pas

Summary

• The neural networks involved in facial affect recognition may differ between TBIs and HCs
• The good news is: we can potentially treat these impairments
• Studying these deficits in TBI are critical as emotional processing deficits may lead to significant interpersonal issues.

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