When Psychophysiology Meets Psychotherapy: Applications and Technical Fine Points

Paul Lehrer PhD
Professor Emeritus
Rutgers Robert Wood Johnson Medical School

1

Peter Lang Studies

- Phobic reactions
- Physiological, cognitive, behavioral decoupling
- What about psychotherapy: specificity of effects

Lang, P. J. (1968). Fear reduction and fear behavior: problems in treating a construct. In: *Research in Psychotherapy*. American Psychological Association, Washington, DC, US, pp. 90–102. https://doi.org/10.1037/10546-004

2

Current psychotherapy practice

- Talk therapy is mostly cognitive; perspective of childhood experiences inappropriately influencing adult emotions
- 'Cognitive behavioral' is more cognitive than behavioral
  - Studies show that exposure and behavior mobilization (behavioral components) are more potent than cognitive therapy
- Few psychotherapy training programs offer intensive training in psychophysiological approaches.
  - Focus of this talk: progressive muscle relaxation, autogenic training, and HRV biofeedback.

3

Behavioral revolution

- Wolpe, *Psychotherapy by Reciprocal Inhibition* (1958)
- Relaxation blocks the anxiety response, allowing exposure to phobic objects without anxiety
- Gellhorn: curarized animals show EEG indications of somnulence.
- James-Lange peripheralist theories of emotion
- **BUT: Curarized people can still be anxious (Davison, 1966)--- so cognitive processes may play an independent role**
  - This paper provided a rationalization for the nascent field of cognitive behavior therapy
  - Nevertheless there are unconfirmed reports of anxiety reduction
  - Human curarization studies: curarization was never complete
  - **Leaves open the issue of psychophysiological *components* of psychopathology**

4

Psychophysiological components in psychological disorders: Generalized anxiety disorder

- Inability to relax
- feeling restless
- feeling keyed up or on edge
- Fatigue
- Trouble sleeping
- Muscle tension or muscle aches
- Trembling, feeling twitchy
- Nervousness or being easily startled
- Sweating
- Nausea, diarrhea or irritable bowel syndrome
- Irritability

5

Other disorders

- PTSD
  - Startle
  - Agitation
  - Insomnia
  - Hyperventilation symptoms
- Panic
  - Hyperventilation symptoms
    - Palpitations
    - Dyspnea
    - Trembling
    - Sweating
- Depression
  - Fatigue
  - Sleeplessness
  - Agitation
  - Poor appetite

6

Bidirectional cognitive and physiological relationship

- somatic symptoms of stress can be triggered by cognitive distortions (Orzechowska et al., 2021; Peterson et al, 2004) and relationship problems (Choi & Marks, 2008; Falahatdoost et al., 2020)
- Cognitive distortions and coping problems can be generated by physical symptoms (Choi & Marks, 2008; Rapgay, 2019)
- Treating cognitive and behavioral symptoms of mental illness can improve physical symptoms as well
- Treating psychophysiological symptoms of mental illness can change cognitions and improve behavioral coping

7

Why not target the psychophysiological components directly

Not necessarily as monotherapy

8

Psychophysiological problems can increase other mental illness symptoms

- Anxiety → muscle tension → sympathetic arousal → anxiety (especially with fear of body sensations)
  - James-Lange theory of emotion
  - (but emotions do produce feelings and physiological events too: Cannon-Bard theory of emotion: an argument for simultaneous cognitive therapy)
- Facial, eye, vocal involvement in depression, anxiety, hallucinations
  - Research by F.J. McGuigan and by Edmund Jacobson 1930's-60's
- Hyperventilation involvement in anxiety and panic
  - Role of sighing and yawning (research by Elke Vlemincx, Frank Wilhelm, W Tom Roth, Paul Grossman and others over the past 20 years)

9

Scoping review of psychotherapy vs psychophysiological therapy

- PsycInfo and Medline for papers, using the following syntax: (biofeedback or relaxation or autogenic) and (psychotherapy or cognitive therapy or cog nitive behavior therapy or CBT or psychoanal*).ti.
- Yield 116 papers
- 25 yielded comparisons

- **Lehrer, P. (2025)** Importance of including psychophysiological methods in psychotherapy. *Applied Psychophysiology and Biofeedback, 50,*169-188,10.10007/s10484-024-09667-w

10

Adding psychophysiological treatment to psychotherapy produces stronger effects

- Autogenic training + psychotherapy > psychotherapy alone
  - Social phobia (Shiga et al , 1999)
  - Depression (Krampen, 1999 2015)
- Progressive relaxation + psychotherapy > psychotherapy alone
  - Anxiety and depression (Buhler, 2017; Caldwell & Steffen, 2018; Krampen, 2015)

11

Adding psychophysiological treatment may not strengthen effects of exposure therapy

- Panic disorder, no significant effect of:
  - Adding breathing retraining (DeRuiter et al, 1989)
  - Adding either relaxation or cognitive therapy for PD with agoraphobia (Michelson et al, 1996)
- Depression. Treatments including relaxation have smaller effects than those without (meta analysis by Furukawa et al, 2021). Includes studies with behavior mobilization

But without psychophysiological therapy to control symptoms, many people will refuse to engage in exposure therapy. Cognitive therapy may be needed to understand the rationale of exposure / psychophysiological therapy

Mindfulness 'just thoughts' 'just hyperventilation'. Can be controlled

12

Less effective with children

- Compared with CBT

- Depression (Eisen & Silverman, 1993)
- Depression and anxiety (Caldwell et al, 2019)
  - More effective with secondary school children, not elementary school

13

Comparisons with other therapies: meta analyses

- In meta analyses compared with CBT
  - ETCO2 biofeedback has greater effects for panic disorder (outlier) (Lehrer et al, 2020)
  - Respiratory therapies including biofeedback have greater effect than other respiratory therapies for anxiety disorders (Leyro et al, 2020)
  - Effects are significantly stronger for treatments with a biofeedback component
  - Relaxation therapy, cognitive therapy, and other effective therapies have equivalent effects for anxiety, but larger than inactive or no treatments (Lehrer et al, 2020, Hafeez & Holsinger)
  - Stress
    - relaxation > CBT, coping skills training, mindfulness, psychoeducation (Yusufov et al , 2019)
    - equivalent to CBT (Guo et al, 2021)
  - Relaxation therapies have greater effects for anxiety and depression (Lo et al, 2018)
- HRVB compared with other effective treatments: no differences (Lehrer et al, 2021)

14

Comparisons in individual studies

- Social phobia: cognitive therapy has greater effects than relaxation + exposure
- Relaxation therapies have weaker effects than CBT
  - Children anxiety disorders (MBilek et al 2022)
  - Panic disorder (Arntz & Hout, 1996; Beck et al, 1994; Clark et al, 1994; Barlow et al, 1989; Michelson et al 1988 for cognitive symptoms); Siev & Chambless, 2007; Murphy et al, 1988) Relaxation decreases metabolic rate and may thus decrease CO2 and exaggerate hyperventilation
- Stronger effects for RT than CBT for panic, PTSD, OCD (Montero-Marin et al, 2018)
- Psychophysiological treatments have greater effects than cognitive therapy on psychophysiological symptoms of panic disorder (Michelson et al, 1990)
- CBT + exposure has the strongest effect ts for anxiety disorders (Whiteside et al, 2020) (But adding psychophysiological tx increases gain for some symptoms)

15

Adding cognitive therapy to relaxation therapy

- Greater effects on depression (Mosley, 1995)
- Greater effects for headaches (Blanchard et al, 1990a with some studies finding no effects (Attanasio et al, 1987; Blanchard et al, 1990b; Mosley, 1995)
- Greater effects for myofascial pain dysfunction (Olson & Malow, 1987)

16

conclusions

- Adding psychophysiological treatments to psychotherapy helps anxiety disorders in adults, not children
- Biofeedback strengthens the effect, particularly ETCO2 biofeedback for panic
- Psychophysiological treatment as monotherapy may be less effective than combined psychotherapies
- Need more comparisons
  - Adding respiratory therapies for anxiety disorders

17

Time ratio between psychophysiological training and other forms of therapy

- First, determine if there is a psychophysiological component to the problem. What does the anxiety/depression *feel* like?
- Use early in therapy where psychophysiological symptoms predominate; later in therapy for some other conditions.
- For a few sessions, training may take a half hour or more of therapy. After that, it consumes much less time
  - Regularly for 4-5 sessions, then periodically: inquiries about use and effects of training; troubleshooting, maybe 10 min of refresher training
- Do training and specific instruction in strategic use of psychophysiological methods, as well as need for regular practice

18

GENERAL ISSUES NOT DISCUSSED IN LITERATURE

- Nature of motivational instructions to participants
- Explanation of training rationale

19

Progressive relaxation rationale and method

The muscles are part of the nervous system that generates anxiety. If you relax the muscles, the physical parts of anxiety will decrease.

The eyes and vocal cords are specifically involved in thinking. Relaxing them will prevent intrusive anxious thoughts

20

Studies of progressive muscle relaxation

- PMR may help head off a panic attack but may increase panic once an attack has started
- Muscle relaxation decreases metabolic rate, further decreasing CO2 output and worsening hyperventilation
- Generally, the form of PMR used is not effective for eliminating low levels of muscle tension
  - Focus on intense muscle contraction rather than minute contraction to increase sensitivity/reduce sensory threshold
    - Weber Fechner law of psychophysics: discrimination is less sensitive at higher levels of stimulation
- Demonstrate

21

Autogenic training rationale and method

- This is a technique of self hypnosis. No one will hypnotize you
- You will use the powers of your mind to change your body, and reduce the physical symptoms associated with your problem
- You will only use suggestion to produce the physical changes that you want. You will always be in control of what you do and what you experience.
- Ask if the person is interested in trying this.
  - Won't work for people who resist it or can't focus their mind (low hypnotizables -- about 10% of the population)
- In 6 standard formulas: Do not try to make anything happen. It doesn't matter if sensations occur or not. Just focus on the formulas.
  - Arms heavy and warm, heart calm and regular, forehead cool, breathing automatic, solar plexus warm

22

AUTOGENIC TRAINING: ignoring fine points

- Passive concentration
- Intentionality (it doesn't matter whether or not you feel it)
  - One of Erikson's rules of hypnotic induction: only tell the person to feel something that they will, in fact, feel
- Account for autogenic discharges
  - Results of disinhibition of some neural connections
  - Transient increases in anxiety, sadness, pain.
  - Do not continue in the face of severe autogenic discharges (very infrequent)
- Adjust formulas for medical complications: diabetes, hyperventilation, ulcers
- Eventually: organ-specific formulas and 'my mind is at peace'

23

Heart Rate Variability Rationale

- Heart rate variability is healthy.
  - It reflects ability to adapt (e.g. HR doesn't go up climbing stairs in people with heart failure)
  - It reflects homeostasis. When it goes up, something makes it go down again; when it goes down, something makes it go up. It is connected to reflexes throughout the body that do this
- HRV biofeedback works on two important reflexes
  - When you breathe in HR goes up; when you breathe out HR goes down
  - When blood pressure goes up HR goes down, causing less blood in the same size tube, thus reducing BP. Opposite when BP goes down, then HR goes up

24

HRVB rationale (continued)

- The blood pressure reflex (BAROreflex, like BAROmeter) is connected in the brain to reflexes that control emotion as well as other physical systems (e.g., the gut, genitals, etc.)
- The baroreflex has a slower rhythm than breathing
  - Breathing is usually about 4 sec/breath
  - Blood pressure cycles up and down for a period of about 11 seconds, different for each person: the amount of time it takes BP to change after HR changes.
- When you breathe at baroreflex frequency, the two reflexes gang up on each other and 'exercise' the homeostatic reflexes throughout the body, making them stronger.
- This allows you to use breathing to control and prevent your symptoms

25

HRVB rationale (cont'd)

- We need to test you to find out the rate of breathing that is specific to you, where these good things happen
- Then just practice breathing at this rate daily, ideally 20 min twice a day, and when you have symptoms
- I tend not to discuss **resonance** much or at all, but, since the word is all over the internet, when appropriate, I approach it this way
  - The bigger the swing in HR at each breath, the more stimulation exercise is given to the various beneficial reflexes that control both mood and various body functions
  - The baroreflex has characteristics of resonance, which magnifies HR swings, much like a musician's sound is magnified in a resonant concert hall, when stimulated at resonance frequency. This gives a bigger swing in HR, and more stimulation and exercise of homeostatic reflexes

26

HRVB procedures

- Try to schedule a session for obtaining resonance frequency
- 4 sessions of training is needed to maximize results
- 2nd session provides a more reliable measure of resonance frequency than the 1st
- If in-person training is not possible, use an app like HRV4biofeedback to determine resonance frequency; or, better, Elite HRV along with an inexpensive Bluetooth sensor (e.g., Kyto) along with protocol similar to one I am distributing

27

HRV biofeedback procedures (cont ‘d)

- Instruct about dangers of hyperventilation (overcompensation for slow breathing). Breathe shallowly. Inquire about hyperventilation symptoms (especially lightheadedniess)
- In a (hopefully temporary) pinch, use paced breathing and guess at resonance frequency
- The average pace is 11 sec **(not 10)**
  - Varies among people from 8-13 sec
  - Partially depends on blood volume. In # sec:
    - Women < men
    - Shorter people < taller
    - Muscular athletes > sedentary

28