

Conscious respiration as a supplementary in treating PTSD: what neuroscience says?

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ABSTRACT

Neuroscientists find major challenges in understanding the connection between the autonomic nervous system and homeostasis to emotional changes which is essential in treating various psychoneurosis cases. Whenever human encounter stressors, the signals from the hypothalamus take over the respiratory signals and increase the respiratory rate to facilitate the fight or flight response. This mechanism confirms the vital relationship between the respiration and emotion resulting in handling acute stress of day to day life. This current study emphasizes that reversing the same biological mechanism of fight or flight responses by conscious control of breathing (biofeedback) may help in balancing emotional imbalance and can be a supplementary treatment to Post Traumatic Stress Disorder (PTSD). In simple terms the harmful effect of PTSD on psychophysiology of an individual can be successfully counteracted with the conscious respiration will be advocated in detail with neuro-scientific evidences.

Keywords: *Conscious Respiration, PTSD*

In everyday life people encounter traumatic events which causes irreplaceable losses and painful wound is technically called Post Traumatic Stress Disorder (PTSD). It can be anything loss of loved one, the loss of a job & property, victims of accident, physical and psychological abuse, natural and man-made disaster. Statistics says one out of two persons will be possibly facing the life-threatening events in their course of life. Men are more likely to exposed to it but women are the high sufferers of PTSD. The affected phase is different to everyone few may overcome in short duration but for few it may last for long term even for life time. Hence it necessitates researchers to understand the mind and body of a person with PTSD to help them to deal with in a better way. The technological development in the field of neurobiology aids the researchers to go beyond pharmacotherapy and to dig out the traditional techniques in treating PTSD to avoid the side effects and dependency of Pharmacotherapy.

HISTORICAL PERSPECTIVE OF PTSD

The historical perspective of PTSD is known for its' combat history. Early attempts of medical diagnosis of PTSD symptoms fallback to the American Civil War (1861-65) and the

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Franco-Prussian War (1870-71). Austrian Physician Josef Leopold (1761) the traumatic experiences such as missing home, feeling sad, sleep problems and anxiety of military soldiers exposed to combat as ‘Nostalgia’ among soldiers and this served as the first model of PTSD. The second model proposed by the U.S. Doctor Jacob Mendez Da Costa suggested that the physical injuries as the cause of symptoms known as “Irritable heart” was identified with rapid pulse, anxiety and trouble breathing which are the result of overstimulation of cardiac nervous system. This also named as “Da costa syndrome” and treated with drugs for soldiers’ effective participation in battle. During 18th century when rail transportation became more common so as the accident. The accident victim Charles Dickens wrote about the symptoms like sleeplessness and anxiety after the traumatic experience. The autopsies of died passengers revealed the injuries of Central Nervous System (CNS). This is another evidence that physical injuries led to PTSD symptoms and European reported it as “railway spine”.

Later at the end of the World War I as a result to the explosion of artillery shells the soldiers experienced the symptoms of panic attack and sleep disturbances of present day which is called as “shell shock” or “War neurosis”. Priorly it was suspected as a result of minor injuries to brain caused by huge machineries but later dropped it when other soldiers who not involved with machineries also had shown similar symptoms. Various treatment had been given to those PTSD sufferers like some got few days of complete civil rest, “hydrotherapy” or “electrotherapy” along with hypnosis. During World War II the Shell shock replaced by the “Combat Stress Reaction” (CSR) or “Battle Fatigue”. Initially military leaders were not ready to believe that CSR is true until a courageous new Army recruit of confederate artillery found in Stephen Cranes Red Badge of courage experiencing same symptoms. Earlier CSR was treated using “Proximity, Immediacy and Expectancy” (PIE). From then the real focus turned towards promoting the recovery of PTSD as well as preventing stress of for effective battlefield fighting.

Currently, in the year of 2013 the American Psychiatric Association (APA) revised and published the fifth edition of Diagnostic and Statistical Manual of Mental Disorders (DSM V). As per that PTSD is included in a new category in *DSM-5* known as Trauma- and Stressor-Related Disorders. In brief *DSM-5* proposes four discrete diagnostic clusters. They are defined as re-experiencing, avoidance, negative cognitions and mood, and arousal. *DSM-5* would require only when disturbance lasts for more than a month to remove the distinction between phases of acute and chronic PTSD (APA, 2013). The treatment for PTSD in current scenario includes pharmacotherapy and various psychological therapies namely Cognitive Behavior Therapy (CBT), Systematic Desensitization Therapy, Cognitive Restructuring and Group Therapy. Still researchers trying to find out more therapeutic procedure by understanding the neurobiology of PTSD in detail as follows.

NEUROBIOLOGY OF PTSD

Recent scientific studies focus on the investigation of different features of neurobiological deviations results in PTSD in terms of neurochemistry and brain deformities [2,8,11,14]. In PTSD the abnormal hormonal regulation of hypothalamic pituitary adrenal axis is found by researchers. When someone exposed to stressors, Corticotrophin releasing hormone (CRH) is secreted by neurons that further ensures the stimulation and production of Adreno Corticotrophin (ACTH) and that stimulates Glucocorticoids the central modulator of metabolism. The transportation of ACTH to adrenal gland releases cortisol. The Cortisol ensures the negative feedback of both hypothalamus and the anterior pituitary by stimulating Sympathetic Nervous System (SNS). Simultaneously, neurons in different brain areas

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modulate the Hypothalamus-Pituitary- Adrenal Axis (HPA axis) activity. The activation of the HPA axis in uncontrollable stress – a situation related to the traumatic experience – that threatens the physical integrity that resulting in a high overall level of daily cortisol release [7]. The result of mal functions of endocrine circuits may have consequences on hypersensitive response to stress, abnormal stress encoding and fear processing. [9]. In recent research on PTSD have been found that increased levels of the catecholamines Dopamine (DA) and Norepinephrine (NE) that may be responsible for the physiological effects as increased pulse and blood pressure, startle response and levels of arousal. They show the sign of negative effect on fear conditioning, encoding fear memories and its responses. Most importantly decreased Serotonin secretion found in PTSD cases which are crucial in dynamic relationship between amygdala and hippocampus, abolishing its capacity to reduce anxiety and contributing to hyper vigilance, interruption of memories and impulsivity. Also reduced GABA activity was found in their restricted ability to moderate physiological response to stressors by PTSD sufferers [6].

BRAINS' DEFORMALITIES OF PTSD

Some of the brain malfunction observed in PTSD sufferers pointed out below:

1. Reduced volume and plasticity found in Hippocampus & Para-hippocampal gyrus which results in exaggerated activation and inability to terminate stress response, deficits in verbal memory Impaired extinction of fear conditioning & non-discrimination between safe/unsafe.
2. Increased reactivity in amygdala results in hyper responsiveness to stressful stimuli but also to neutral stimuli as faces.
3. Decreased volume of Pre-Frontal Cortex (PFC) and under functioning of Medial PFC results in decreased reactivity of PFC to exert inhibitory control over stress responses, decreased emotional reactions.
4. Identified under functioning of Anterior Cingulate Cortex (ACC).
5. Increased reactivity of Sensory motor cortex shows hyperarousal when traumatic stimulus exposure. (Sakellariou MO, Stefanatou A, 2017)

The clinical picture of PTSD reveals the trouble experiencing, the tendency to respond to triggers of present with action patterns of past traumatic experience, attention difficulties, the difficulties in articulation of sensations, feelings and physical condition. By standing These facts a pioneer in the field of treatment of PTSD, Bessel A. Van der Kolk questions that, are the traditional approaches of CBT and psychodynamic therapies are really insightful enough in treating PTSD sufferers? Further, he says that “Neither CBT nor psychodynamic therapy pay satisfactory attention for preprogrammed action patterns of traumatic events of past to the distressed physical sensations & experience of present. Instead the therapies should focus on action-oriented programs in rerouting of passive fear conditioning of PTSD in concern with both mind-body relation. Researcher suggesting that awareness-based body-oriented therapy can be beneficial in reestablishment of a sense in physical control, by using breath and body program in order to alter physiological arousal by conscious regulation of breath and body movement. [4,6,10,15,16].

Conscious Respiration & PTSD

The conscious and unconscious breathing activates different brain region. The primitive part of brain, Medulla Oblongata of the brain stem is involved in unconscious breathing, while in conscious breathing highly stimulated brain region is cerebral cortex. The impulses of this cortex and connecting areas has as notable impact on emotions. Relaxing and balancing effect of emotion can be attained through activation of cerebral cortex which sends

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inhibitory impulses to the Mid-brains' respiratory region. The inhibitory impulses from the cortex reaches the hypothalamus (emotional brain) the controller of emotion and relaxation. And, thus the conscious activation of hypothalamus calms the emotional turbulences.

Practitioners argues that the conscious breath has the ability to alter the state of mind. Scientific studies have emphasized the enormous benefits of Asanas, pranayama and other controlled breathing techniques. Also, they noticed the practitioners demonstrated increased psychophysiological health and improved cognitive abilities. Which includes positive physiological effects of decreased heart rate, blood pressure and inflammation, with improved physical balance and strength. Also they witnessed a great reductions in various psychological symptoms connected to depression, anxiety disorders, PTSD and pain. Furthermore, the practices shown tremendous improvement in working memory and decision-making. Yet, the theory behind how consciously controlled breathing affects the neurophysiology and related health benefits remains unclear and demands scientific explanation. (Gerritsen RJS & Band GPH, 2018). This inspires the scientists to unlock the suspense of the connection between conscious respiration and its effect on mind – body relationship.

As a result, they came up with neuro-physiological model of the breath that emphasizes on communication by vagus nerve that connects the heart, lungs and digestive tract to the brain parasympathetic nervous system (PNS). The nerve is accountable for sending and receiving signals. Scientists believe that controlled deep breathing right away activates the PNS via the vagus nerve by the receptors' signals of lungs. These receptors has been triggered in taking deep breath. This biofeedback mechanism of breathing results in state of relaxation by signaling the brain center for breathing in the brainstem. The brainstem further responds by sending signals out to cut down the stress. This mechanism could clarify the doubt on positive effects on mental and physical health after practicing conscious breathing exercise.

This theory furtherly proved by a research carried out with mouse in Stanford University by Mark Krasnow lab. They found a group of neurons in the mouse brain which connect the brainstem's breathing center to the parts involved arousal and attention. When the functions of those neurons frozen, the mice demonstrate a calm state, despite researchers trying to induce excitement and stress. This finding certainly explains that the signals of state of stress and turbulence are generally communicated from the breathing center to the rest of the brain. This is the exclusive study to demonstrate how mechanism of conscious breathing impacts mind states. Hence it is believed to be applicable in human Since the same brain regions exist in human as well. (Yackle K. et al.,2017). As a Further proof on effect of breathing technique on PTSD was declared by the University of Wisconsin-Madison (2014). The Center for Investigating Healthy Minds at the Waisman Center under the university of proved a better hope on meditation based on breathing practice named Sudarshan Kriya Yoga can be an effective treatment for PTSD. In addition to that, in 2016 Anselm Doll and his colleagues at the Technical University of Munich, showed that this attentional focus on breath helps in reduction of stress and its negative impacts on emotions. Also, they found this focused breathing it activates the dorsomedial prefrontal cortex the regulatory area of the brain, and reduces activities of amygdala which is directly involved in fear and emotions.

CONCLUSION

To develop methods of treating a disease is the responsibility of the researchers and clinicians is a well understood global phenomenon. The traumatic experiences remain unavoidable and the impacts are unsolvable. So it is clear that treating symptoms are beneficial rather avoiding symptoms. Overall, the analysis evident that the symptoms of

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PTSD and conscious respiratory are deep routed with same neurobiology but the impact on psychophysiological function is in different direction. Which means PTSD and conscious respiratory has negative relation. So, it is clear that by inducing Breathing techniques we can reverse the symptoms of PTSD undoubtedly. Hence conscious respiration technique can be used as one of the supplementary in treating PTSD.

REFERENCES

1. American Psychiatric Association, *PTSD*, 2013.
2. Bowirrat, A., JH Chen, T., Blum, K., Madigan, M., A Bailey, J., Lih Chuan Chen, A., ... & Kerner, M. (2010). Neuro-psychopharmacogenetics and neurological antecedents of posttraumatic stress disorder: unlocking the mysteries of resilience and vulnerability. *Current Neuropharmacology*, 8(4), 335-358.
3. Creswell, J. D. (2017). Mindfulness interventions. *Annual review of psychology*, 68, 491-516.
4. Gapp, K., von Ziegler, L., Tweedie-Cullen, R. Y., & Mansuy, I. M. (2014). Early life epigenetic programming and transmission of stress-induced traits in mammals: how and when can environmental factors influence traits and their transgenerational inheritance?. *Bioessays*, 36(5), 491-502..
5. Gerritsen, R. J., & Band, G. P. (2018). Breath of life: The respiratory vagal stimulation model of contemplative activity. *Frontiers in human neuroscience*, 12, 397.
6. Mahan, A. L., & Ressler, K. J. (2012). Fear conditioning, synaptic plasticity and the amygdala: implications for posttraumatic stress disorder. *Trends in neurosciences*, 35(1), 24-35.
7. Miller, G. E., Chen, E., & Zhou, E. S. (2007). If it goes up, must it come down? Chronic stress and the hypothalamic-pituitary-adrenocortical axis in humans. *Psychological bulletin*, 133(1), 25.
8. O'Doherty, D. C., Chitty, K. M., Saddiqui, S., Bennett, M. R., & Lagopoulos, J. (2015). A systematic review and meta-analysis of magnetic resonance imaging measurement of structural volumes in posttraumatic stress disorder. *Psychiatry Research: Neuroimaging*, 232(1), 1-33.
9. Perroud, N., Rutembesa, E., Paoloni-Giacobino, A., Mutabaruka, J., Mutesa, L., Stenz, L., ... & Karege, F. (2014). The Tutsi genocide and transgenerational transmission of maternal stress: epigenetics and biology of the HPA axis. *The World Journal of Biological Psychiatry*, 15(4), 334-345.
10. Sakellariou, M. O., & Stefanatou, A. (2017). Neurobiology of PTSD and implications for treatment: An overview. *Current Research: Integrative Medicine*, 2(1).
11. Sartory, G., Cwik, J., Knuppertz, H., Schürholt, B., Lebens, M., Seitz, R. J., & Schulze, R. (2013). In search of the trauma memory: a meta-analysis of functional neuroimaging studies of symptom provocation in posttraumatic stress disorder (PTSD). *PloS one*, 8(3), e58150.
12. Sherin, J. E., & Nemeroff, C. B. (2011). Post-traumatic stress disorder: the neurobiological impact of psychological trauma. *Dialogues in clinical neuroscience*, 13(3), 263.
13. Sakellariou, M. O., & Stefanatou, A. (2017). Neurobiology of PTSD and implications for treatment: An overview. *Current Research: Integrative Medicine*, 2(1).
14. Stark, E. A., Parsons, C. E., Van Hartevelt, T. J., Charquero-Ballester, M., McManners, H., Ehlers, A., ... & Kringelbach, M. L. (2015). Post-traumatic stress influences the brain even in the absence of symptoms: a systematic, quantitative meta-analysis of neuroimaging studies. *Neuroscience & Biobehavioral Reviews*, 56, 207-221.

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15. Yehuda, R. (2002). Clinical relevance of biologic findings in PTSD. *Psychiatric Quarterly*, 73(2), 123-133.
16. Van der Kolk, B. A. (2006). Clinical implications of neuroscience research in PTSD. *New York*.
17. Yehuda, R., Daskalakis, N. P., Bierer, L. M., Bader, H. N., Klengel, T., Holsboer, F., & Binder, E. B. (2016). Holocaust exposure induced intergenerational effects on FKBP5 methylation. *Biological psychiatry*, 80(5), 372-380.
18. Yackle, K., Schwarz, L. A., Kam, K., Sorokin, J. M., Huguenard, J. R., Feldman, J. L., & Krasnow, M. A. (2017). Breathing control center neurons that promote arousal in mice. *Science*, 355(6332), 1411-1415.

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Conflict of Interest

The author declared no conflict of interest.

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