

Part I: A Study of Memory according to Yoga and Spiritual Lore
Part II: Changes in Brain Wave Coherence and Heart Rate Coherence during
kapalabhati, A Yogic Breathing Practice

By

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Abstract

Part I: A Study of Memory according to Yoga and Spiritual Lore

The Vedas are the earliest available records of Indian literature. Mimamsa and Vedanta may be regarded as the direct continuation of the vedic culture. Though the Sankhya, yoga, Nyaya and Vaisesika based their theories on ordinary human experience and reasoning. Thus, Authority or the testimony of the reliable person and scriptures forms the bases of philosophy.

The ability to remember and forget is one of the most complex and fascinating functions of the brain. It is well known that memory lapses are extremely selective; we remember some things and forget others. Memory is called smrti. As regards the means of memory there is great divergence among the different systems of philosophy. The Aitereya Upanisat tells about samskara janya and Manojanya smrti.

Patanjali says the process by which thoughts which have been experienced are retrieved is memory. Caraka says remembering the things which we have seen, heard, experienced is known as Smrti. Yoga Vasistha says remembering the things which we have seen, heard, experienced is known as Smrti. He also mentions how it acts in different layers of human beings. According to Tarka Sangraha. Smrti is the nature of atma. It is knowledge in the form of remembering. It is a dharma of atma says Nyaya Darsana. It acts as an obstacle says Patanjali and Sri Krishna in Bhagavadgita.

Summary and conclusion

When one's memory is in good condition, it means activities are well organized its usefulness is confirmed, this is how the whole mechanism of one's success takes place.

We are in the era of science and technology and the era of researches,

developing ourselves predominantly by an increase in power of analysis, logic and discrimination, no doubt we have been able to unravel the mysteries of this physical universe in its greatest depth. In this regard the left-brain development is wonderful and amazing. Like how right brain is also very important for the overall development of a human being utilizing our left brain is absolutely necessary.

Everyone is convinced that memory plays a vital role in achieving success in life, both in the conventional sense as well as for personal growth and spiritual development.

As regards the subject memory there is great divergence among the different systems of philosophy. According to Caraka a memory is nothing but remembrance of things directly perceived, heard (from scriptures) or experienced earlier.

According to Gita Memory is the base of imaginations and thoughts. Man is thought to be intellectual due to the power of remembrance as the old experiences remain with him as impressions. Lack of memory leads to the loss of knowledge (buddhi) which may destroy the individual.

The third facet of mind is smriti or memory. The storehouse of information is sorted out by the intellect the buddhi and what ever is decided to be stored is passed on to memory. Not all information needs to be stored only those important thoughts, which the Buddhi decides, will find entry into memory. They will be ready to be unearthed anytime we need. Retrieval of information list of memory. The memory is defined as: "The process by which thoughts which have been experienced are retrieved is called memory".

One can improve memory power in different levels by following Patanjali's Asthanga Yoga.

In the spiritual evolution of man memory plays a vital role. Patanjali says Yoga is the control of thought-waves in the mind. Hatha Yoga Pradipika says, one whose mind is neither asleep nor awake, (whose mind), is devoid of memory and forgetfulness, neither oblivious nor active, is indeed liberated. Memory thus becomes closely linked up with epistemology, the study of knowledge and ontology. Memory comes under the study of knowledge; both are necessary to each other. Two are inseparable to the path of perfection.

Part II: Changes in Brain Wave Coherence and Heart Rate Coherence during kapalabhati, A Yogic Breathing Practice

Background: Yogic texts recommend kapalabhati as a technique to improve alertness of the mind. Studies on the physiological effects of Kapalabhati have shown sympathetic arousal during the practice. It will be useful to record the changes in brain waves and the autonomic nervous system at the same time during the practice of kapalabhati.

Objectives: To evaluate the changes in Heart Rate Coherence & Brain Wave Coherence during kapalabhati in healthy volunteers.

Methods: 31 healthy volunteers between 20 to 50 years of age participated in this randomized self control study. All subjects had prior training in the practice of kapalabhati and were made to come for recording on two different days for two sessions of recording the experimental (kapalabhati) and control (breath awareness). The day of recording (first or second day) of the two sessions was randomized by using a computer generated random number table. The structure of the 20 minute session was (same durations for both sessions) 5 minutes of rest with breath awareness (Post). The practice of kapalabhati (specific style of yogic breathing) which had 5 rounds, consisting of one minute of rapid exhalation at 60 per minute alternating with one minute of rest (with free breath awareness). During the control session the subject continued to be seated with breath awareness for the entire period of 20 minutes (5min.pre + 10min.during +5 min.post). Outcome measures: Heart Rate Coherence (HRC) is a measure of the power spectral density in three different frequency ranges of the Heart rate variability frequency (low=0.01 to 0.08 Hz., medium=0.01 to 0.15 Hz., and high=0.15 to 0.5 Hz) obtained by Fast Fourier transformation of the RR intervals from a heart rate monitor recorded by using Freeze framer Version 2.0 interactive learning system manufactured by Heart math, California, USA.

Brain wave coherence (BWC) is a measure of the coherence between right and left hemispheres of the brain waves (alpha and delta) of the EEG tracing recorded from C3 and C4 sites on right and left side of the scalp (measured using brain master machine Michigan, USA).

Results: For heart rate coherence the baseline values were matched and normally distributed. There was a significant increase in the low coherence

during kapalabhati, indicating sympathetic arousal. The medium and high coherences of HRC decreased significantly during kapabhati, which indicates heightened sympathetic arousal or increased parasympathetic tone. The percentage of alpha in both C3 and C4 (right and left) increased significantly during and after kapalabhati ($p < 0.05$) with a significant difference between groups ($p < 0.05$) during and after the sessions. The percentage of delta increases after kapalabhati session with between groups difference between or during the sessions in the coherence between the hemispheres in alpha or delta waves

Conclusion: HRC revealed that there was an increase in sympathetic activity during and after kapalabhati. BWC showed significant increase in both alpha and delta waves after kapalabhati with no change in coherence. Further studies on long-term practitioners may reveal changes in coherence.

Summary and conclusion

This was a randomized self as control design on 31 male and female students who were undergoing Yoga Foundation Course. The subjective Experience of alert full rest after the practice, Heart rhythm Coherence and Brain Wave Coherence were measured during the practice of kapalabhati as compared to a control session of breath awareness.

The degree of alertful rest was higher after kapalabhati. In HRC there was an increase in low coherence and decrease in high coherence during kapalabhati session indicating increased sympathetic activation. In BWC there was significant increase in alpha and delta waves in both C3 and C4 during kapabhati session with no change in coherence between the hemispheres.

Keywords: Yoga, Spiritual Lore, Brain Wave Coherence, Heart Rate Coherence, kapalabhati.