Effect Of Anulom Vilom Pranayam On Visual Reaction Time In Young Adults Of Indian Population

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Abstract: Background: Reaction time, an indirect but reliable index of the processing ability of central nervous system, is significantly correlated to changes in breathing period. Objective of the study was to evaluate effect of Anulom Vilom pranayam on visual reaction time. Method: 60 subjects (study group 30 subjects and control group 30 subjects) from a tertiary care hospital of Mumbai were included in the study. Subjects from study group practised Anulom Vilom pranayam for 8 weeks and subjects from control group were busy in their routine activities during that period. Pre-study and post-study measurements of visual reaction times for red and green light were done in both groups. Result: Statistical analysis was carried out and paired t-test was applied. Post-study visual reaction time of study group for red and green light showed significant decline than control group. Conclusion: Anulom Vilom pranayam which observed to reduce visual reaction time have health promoting, boosting and toning effects on central neural structures, quantity and pattern of release of neurotransmitters and mental interaction involved in information processing. Thus, Anulom Vilom pranayam is complementary to overall stress management.

Key Words: Anulom Vilom pranayam, Stress management, Visual reaction time.

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Introduction: During our day –to– day experiences we detect changes in the environment and react appropriately. Often we have to respond almost instantaneously to different simple as well as complex stimuli.

Human reaction time (RT) is the time interval between the application of a stimulus and the appearance of appropriate voluntary response by a subject[1]. Reaction time provides indirect but reliable index of the processing ability of central nervous system and a simple mean of determining sensory-motor association and performance[2]. Measurement of reaction time is a sensitive, reproducible and non-invasive test and can be done with simple apparatus and set up. It is useful in the study of peripheral as well as central neural structures. It acts as a reliable indicator of rate of processing of sensory stimuli by central nervous system and its execution in the form of motor response[3]. It is an index of cortical arousal[4] and decrease in it indicates an improved sensory-motor performance and an enhanced processing ability of the central nervous system.

It has been found that changes in breathing period produced by voluntary control of breathing are significantly correlated to changes in reaction time[5]. Physical conditioning exercises have been shown to shorten Visual reaction time (VRT)[6]. Various Method of pranayam are mostly characterized by breath holding at the end of maximum inspiration or maximum expiration and slowing of the respiratory rate. They also bring equipoise between psychic and somatic aspects of bodily functions[7]. Pranayam which is a yogic breathing technique produces consistent physiological changes and have sound scientific basis[8]. The physiological and psychological benefits of pranayama have been demonstrated in several studies[9]. Benefits have been reported in peripheral nerve function[10] as well as central neuronal processing[11]. Studies have demonstrated that subjects trained in yoga and pranayam can achieve a state of deep psychosomatic relaxation (undisturbability)[12].

Having a short reaction time is vital in our day to day lives and also it has important implication in sports physiology. From biological point of view, an animal's ability to cope with the environmental changes for the maintenance of homeostasis depends on the integrity of cell communication and responses given by the various systems in terms of sensory perception and motor response.

The above observations gave us an impetus to study the effect of practicing Anulom Vilom pranayam on visual reaction time. We have tried to construct a neurophysiological explanation for the results.

Material and Method: The study was conducted in a well-known tertiary hospital in Mumbai after the institutional ethical clearance. The participants of the study were medical students of age group 18 to 22 years of both the sexes. Informed and written consent was taken from all the participants. The duration of the study was eight weeks[13]. Students who don't have any neurological illness, any acute illness, having normal vision were included in this study after detailed history and clinical examination to detect systemic involvement of any disease. Those participants who were having red-green colour blindness, any organic disease of eye and nose, chronically ill or under any drug treatment and those who are undergoing any physical activity such as sports, athletic training or any other type of physical exercise were excluded from this study.

The apparatus used for measuring reaction time in this study was "Research Reaction Time apparatus" manufactured by Anand agencies, Pune-2. Visual reaction time was measured where subject has to respond to red and green colour stimuli by pressing the response button and the readings were recorded in milliseconds on the digital screen of the apparatus for red and green colour light respectively. Subjects were given practice session before actual measurements.

Before the start of study, Visual reaction time (VRT) for red light and green light were measured in all 60 voluntary participants. After taking the pre-study readings, the 60 individuals were divided into study group and control group, each group containing 30 subjects of both sexes. Each individual from the study group was explained about the procedure of Anulom Vilom pranayam and sufficient trials were given for proper understanding. Anulom Vilom pranayam was practiced by the subjects of study group daily once in the morning for a period of 8 weeks on regular basis under our direct supervision without any holiday during the study period and the subjects from the control group were busy in their routine activities during that period. No subject in either group has been performing any pranayam before. At the end of 8 weeks parameters of the study were reassessed in both the study and control groups under similar environmental conditions.

Procedure of Anulom Vilom pranayam[14]: The subject was seated in a comfortable sitting posture with back straight. Inhalation is through one nostril, and then breath is retained followed by exhalation through the other nostril in a ratio of 2:8:4, with eyes closed and concentrating on breathing.

One round of Anulom Vilom pranayam consists of six steps:-

i. Inhale through the left nostril, closing the right with the thumb, to the count of four.
ii. Hold the breath, closing both nostrils, to the count of sixteen.
iii. Exhale through the right nostril, closing the left with the ring and little fingers, to the count of eight.
iv. Inhale through the right nostril, keeping the left nostril closed with the ring and little fingers, to the count of four.
v. Hold the breath, closing both nostrils, to the count of sixteen.
vi. Exhale through the left nostril, keeping the right closed with the thumb, to the count of eight.

This is one complete round of Anulom Vilom pranayam. After every 10 minutes one takes rest pause for 20-30 seconds. This procedure was practiced for 20 minutes daily. Data was collected and the level of significance was tested by paired t-test by SPSS software version 16.0 for windows. The p-value less than 0.05 indicate that the results are significant statistically and the p-value less than 0.01 indicate that the results are highly significant statistically.

Result:

Table 1: Pre-study and post-study visual reaction time (VRT) for red light in study group and control group

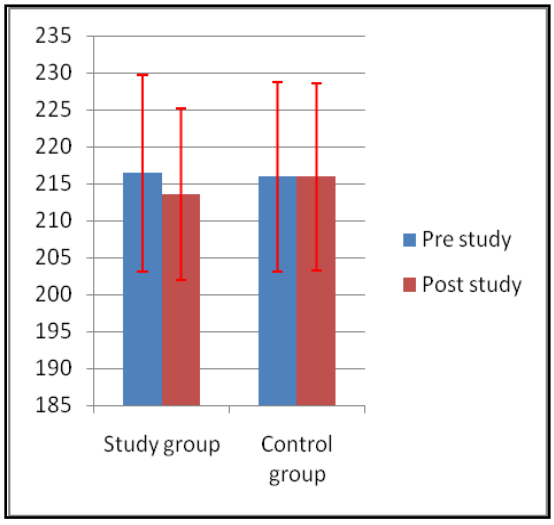
Values are expressed as Mean ± Standard Deviation. N=30 in each group.

Visual reaction time (VRT) for red light				
	Control group		Study group	
	Pre-study	Post-study	Pre-study	Post-study
VRT for red light	215.9 ± 12.8	215.9 ± 12.6	216.4 ± 13.3	213.6 ± 11.6
t-value	0.081		4.785	
95% CI	-1.107 to 1.174		1.159 to 4.308	
p-value	0.936 (NS)		0.01(S)	

Note: CI= Confidence interval, S= Significant, NS= Non Significant

Table 1 shows that visual reaction time for red light in the subjects from study group was found to be significantly decreased (p value <0.01) when compared before and after Anulom Vilom pranayam whereas, the corresponding change in control group was not significant (p value >0.05).

Graph 1: Pre-study and Post-study VRT for red light in study group and control group



Graph 1 shows difference in the pre-study and post-study VRT for red light in the study group whereas none at all in the control group. Even in study group there is considerable overlapping of the error bars of standard deviation (SD).

Table 2: Pre-study and post-study visual reaction time (VRT) for green light in study group and control group

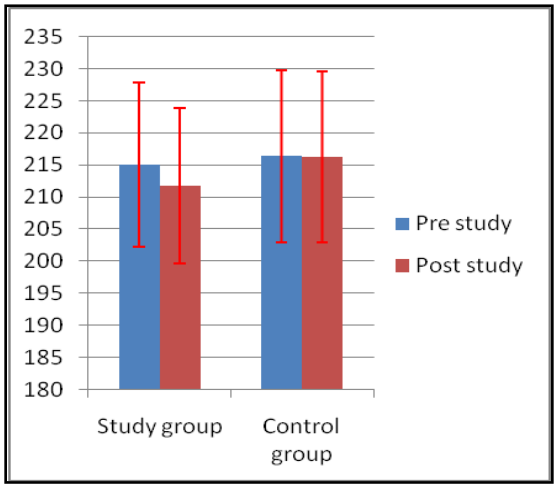
Values are expressed as Mean ± Standard Deviation. N=30 in each group.

Visual reaction time (VRT) for green light				
	Control group		Study group	
	Pre-study	Post-study	Pre-study	Post-study
VRT for green light	216.4 ± 13.4	216.2 ± 13.3	215.07 ± 12.8	211.8 ± 12.1
t-value	0.665		23.02	
95% CI	-0.839 to 1.372		2.817 to 3.583	
p-value	0.511(NS)		0.01 (S)	

Note: CI= Confidence interval, S= Significant, NS= Non Significant

Table 2 shows that visual reaction time for green light in the subjects from study group was found to be significantly decreased (p value <0.01) when compared before and after Anulom Vilom pranayam whereas, the corresponding change in control group was not significant (p value >0.05).

Graph 2: Pre-study and Post-study VRT for green light in study group and control group



Graph 2 shows difference in the pre-study and post-study VRT for green light in the study group whereas none at all in the control group. Even in study group there is considerable overlapping of the error bars of standard deviation (SD).

Discussion: In present study visual reaction time decreases after practicing Anulom Vilom pranayam in study group which was statistically significant. This observation indicates and can be explained on the basis of improved sensorimotor performance due to an enhanced processing ability of the central nervous system. These effects could be due to greater improved concentration power, ability to ignore and/or inhibit extraneous stimuli and also due to its beneficial effect on the autonomic nervous system. Reaction time gives us insight about the efficiency of information processing which involves the nature, intensity, frequency, pattern of stimuli, structural and functional characteristics of neuronal receptors, afferents, centers (i.e. central neurons), efferents and neurotransmitters. It is also influenced by several host factors like gender, age, level of consciousness, personality types, exercise, training, practice and errors etc.; several physiological factors like breathing cycles, fasting; environmental factors like types of stimuli; disease factors like lesions of central nervous system, musculo-skeletal system, physical illness (hypothyroidism), mental illness; abnormal conditions like brain injury, finger tremors; drugs factors like use of sedatives and toxicological factors like consumption of alcohol. In chronological studies like ours, it is influenced by the interaction of the individual and the environment which constitutes the degree of stress. Hence it is logical that if specific training in stress management is given then the information processing would improve and the reaction time would reduce[15].

In human beings information processing is affected by the instinctual status, mental status, instinctual and intellectual development. Thus, a person with emotional disturbance or a confused or baffled individual would take more time to respond as compare to other individual with greater intellectual and emotional composure and conceptual clarity. Being pranayam an art of control of breathing, a practitioner of Anulom Vilom pranayam not only tries to breathe, but at the same time, tries to keep his/her attention on the act of breathing, leading to concentration. This act of concentration removes his attention from worldly worries and de-stress him/her. This stress free state of mind evokes relaxed responses[16]. In this relaxed states, parasympathetic nerve activity overrides sympathetic nerve activity[17].

Pranayam shows a reduction in sympathetic activity which is the basis of its use in stress management[18]. In Anulom Vilom pranayam, the idea is to maintain a slow rhythmic pattern of breathing using both nostrils alternately which also produces a beneficial effect on the autonomic nervous system as reported in a study as decrease in sympathetic tone, and the associated increase in parasympathetic tone following pranayam[19]. Another study reported that pranayam rapidly alters cardiopulmonary responses and improves simple problem solving[20]. Other studies reported the effect of short term training in slow breathing pranayam on reaction time and found that there was appreciable but statistically insignificant shortening of reaction time[21].

Another study reported that nostril rhythm in pranayama increases the theta rhythm, the mean alpha (a) and beta (b) power followed by reduction in the asymmetry in b band in the EEG[22] indicating facilitation of processes of sensory signal transmission. As stated above, previous training is an important factor affecting reaction time and pranayam is also found to reduce reaction time. Thus pranayam in general and Anulom Vilom pranayam in particular which are observed to reduce visual reaction time have health promoting, boosting and toning effects on all the neuromuscular structures involved, central neural structures, quantity and pattern of release of neurotransmitters, and mental interaction involved in information processing. This is how, Anulom Vilom pranayam makes the mind steady and hence less distractible, more acute, pointed, precise, and quick in responding to any stimuli. The intricacies of central and autonomic nervous mechanisms involved in the effects of Anulom Vilom pranayam on visual reaction time needs further more psychophysiological, electrophysiological and neurobiochemical studies.

Conclusion: Anulom Vilom pranayama is complementary to overall stress management (physical, instinctual, emotional, intellectual and spiritual). Hence the best effects of these techniques would be evident if coupled with the other measures involved in Total Stress Management.

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