DOI: 10.18410/jebmh/2015/1001

ORIGINAL ARTICLE

EFFECT OF PRANAYAMA AND EYE EXERCISES ON EYE TO HAND COORDINATION: STUDY BY FINGER DEXTERITY TEST

Nitin Gosewade[1], Vinod Shende[2], Chhaya Saraf[3], Amol Drugkar[4]

HOW TO CITE THIS ARTICLE:
Nitin Gosewade, Vinod Shende, Chhaya Saraf, Amol Drugkar. "Effect of Pranayama and Eye Exercises on Eye to Hand Coordination: Study by Finger Dexterity Test". Journal of Evidence based Medicine and Healthcare; Volume 2, Issue 42, October 19, 2015; Page: 7400-7406, DOI: 10.18410/jebmh/2015/1001

ABSTRACT: BACKGROUND: Our eyes are body's most well developed sensory organs. Indeed, a far larger part of our brain is devoted to the functions of eyesight than to those of hearing, taste, touch or smell together. We usually take our eyesight for granted, although when vision problems develop, most of us will do everything in our capacity to restore our eyesight to normal. Eyes work together to perceive depth thus allowing us to coordinate with motor actions. Practicing relaxation exercises in the form of pranayama and eye exercise has been shown to improve motor functions and attention. **AIM:** To study the effect of pranayama and eye exercises on eye to hand coordination. **MATERIALS AND METHODS:** The present study consisted of 60 healthy subjects divided equally into two groups. One group practiced kapalabhati pranayama and eye exercises for eight weeks whereas other group did not participate in any kind of exercise. The effect of pranayama and eye exercises on eye to hand coordination were assessed by finger dexterity test by using O'Connor finger dexterity task. **RESULTS:** There was significant improvement in eye to hand coordination in subjects practicing pranayama and eye exercises. Finger dexterity test values in study group before and after intervention were 31±4.94 and 33±4.98 respectively. Whereas in control group the values were 29.9±5.7 and 30.1±5.31 respectively. **CONCLUSION:** Both Kapalabhati pranayama and eye to hand coordination can improve fine motor skills

KEYWORDS: Pranayama, Eye exercises, Kapalabhati, Finger dexterity.

INTRODUCTION: Despite the fact that the eyes are tiny in size compared to most of the body's other organs, their structure is incredibly complex. Eyes work in sync to perceive depth, allowing us to judge distance and the size of objects to help us move around them. Not only do the two eyes work together but also they work with the brain, muscles, and nerves to produce complicated visual images and messages. Perception is frequently discussed with reference to hint as a separate source of information for the perceiver.(1) These hints are then correlated with the way in which the sensory apparatus has physically and computationally evolved. Sensory perception and discrimination of shapes and sizes depends on haptic or tactile cues.(2) Thus shape and size detection needs particular stereotypical movements.(3) These movements are often like the scanning movements of the fingers.(4) Although these movements are not directly concerned with the kind of movements mentioned above, finger movements involved in performing a dexterity task are also necessary for haptic sensitivity; the two (i.e. size discrimination and dexterity) being influenced by similar factors.(5,6)

Yoga is an ancient Indian science which contains specific postures, voluntary breath regulation, meditation, and certain philosophical principles.(7) Yoga is one of the important

DOI: 10.18410/jebmh/2015/1001

methods to improve the fine motor coordination ability. There are eight different stages or limbs of yoga. Pranayama "prana" + "yama" is the fourth limb of yoga which balances nervous system and improves mental clarity and physical coordination.[8] Yoga training enhances the grip strength, dexterity, confidence, self-efficiency, mental health, creativity, concentration, memory & intellectual abilities. Yoga also influence several motor functions including static motor performance, tweezer dexterity as well as visuomotor speed.[8,9,10,11,12,13] Kapalabhati pranayama along with breath awareness enhances fine motor skills measured by finger dexterity and visual discrimination assessed by the shape and size discrimination task.[6] Hence this study was carried out to see the effect of pranayama and eye exercise techniques on eye to hand coordination by finger dexterity test.

MATERIALS AND METHODS:

Study Design: The present study was carried out in Physiology Department, Seth G.S Medical College & KEM Hospital, and Mumbai. Total 60 young healthy subjects (both male and female) who were in the first year MBBS at Seth GSMC Mumbai, in the age group of 18–30 years and who belonged to similar socio–economic status were recruited in the study. All the study participants were staying in college hostel having similar eating and sleeping patterns. The study subjects were selected according to following inclusion and exclusion criteria.

Inclusion criteria:

1. Indian subjects with or without refractory error were included.
2. Both male and female subjects were included.
3. Subjects with age group of 18-30 years of age were included.

EXCLUSION CRITERIA:

1. Subjects with colour blindness were excluded from the study.
2. Subjects with organic diseases like glaucoma, eye infections, eye injury, malignancy, post-surgery for refractive errors, squint.
3. Subjects suffering from medical conditions known to impact cognitive functioning like neurological disorders, head injuries, cardiovascular diseases and diabetes were excluded.
4. Subjects not willing to give written consent were excluded.

All the participants were briefed about the nature of study and written informed consent was taken from each study participant. Study was approved by the Institutional ethical committee.

Study participants were divided randomly into two groups; study group and control group. Each group contains 30 subjects (18 male and 12 female). Baseline finger dexterity test values were recorded from each study participant irrespective of their group before starting the study. Study group participants were taught eye exercises and kapalbhati pranayama. They practiced eye exercises and pranayama twice a day for (total one hour) the period of 8 weeks regularly under supervision. Control group participants were busy with their routine activities and were not given any exercise. After 8 weeks Finger dexterity test was performed on all subjects to see the effect of eye exercises along with kapalbhati pranayama on eye to hand coordination.[14]

DOI: 10.18410/jebmh/2015/1001

STUDY PROCEDURE: Study group participants practiced the following exercise techniques regularly as per protocol for a period of 8 weeks.

1. **Palming and Visualization with Kapalbhati:** In this exercise, subject has to rub his/her palms over each other to make them warm. Close the eyes and cover them with the palms, allowing the fingers to cross on the forehead. The hands have to be cupped so that no pressure is put on the eyeballs. After that open the eyes and see if any light is getting in. If so, the hands should be moved so that no light enters and then close the eyes again. The warmth of the hands, combined with blocking out all light, relaxes the pair of tense eyeballs.

Kapalbhati: While palming, subject has to exercise the diaphragm by exhaling suddenly and quickly through both nostrils, producing a hissing sound. Inhaling is automotive and passive. The air should be exhaled from the lungs with a sudden, vigorous inward stroke of the front abdominal muscles. The abdominal stroke should be complete and the breath should be expelled fully. While inhaling, no willful expansion is necessary and the abdominal muscles should be relaxed. This exercise should be done in three phases, each consisting of 20 to 30 strokes a minute. A little rest can be taken in between. Throughout, the thoracic muscles should be kept contracted.[8] Subject has to practice it as a 5–10 minute sessions, at least twice a day. If this is found unpleasant, one can try mini–sessions, palming for a period of 15 breaths, up to 20 times a day. Palming may also help when the eyes become tired and bleary.

2. **Blinking:** Subjects are instructed to make a habit of blinking regularly, once or twice every 10 seconds. It cleans and lubricates the eyes especially in glass and contact lens wearers.

3. **Near and far focusing with Kapalbhati:** Subject has to hold two pencils or index fingers, in front of the face–one about 7.5 cm away, the other at arm's length. Then he/she has to focus on one with eyes, then blink and focus on other. One has to repeat several times whenever an opportunity arises. Subjects have to practice kapabhati pranayama while doing focusing exercise.

4. **Shifting with Kapalbhati**: Shifting is necessary to avoid eye strain. Staring is harmful for eyes. One should not stare fixedly at an object. Subject has to pretend that he/she is looking at the center of a giant clock with face straight ahead. Keeping the head still all the while, subject has to look up as far as possible towards the 12 O'clock position, hold for 2 seconds, then move the gaze clockwise at 3' O'clock, then 6' O clock, then 9' O clock and return to 12' O clock position. At every position he/she has to hold for two seconds and expire in three bouts with abdominal muscles contractions i.e., Kapalbhati. Then repeat the cycle anticlockwise. Subject has to practice this three times clockwise and three times anticlockwise, alternately.

5. **Splashing:** Every morning subject has to splash closed eyes 20 times with warm water and then 20 times with cold water. Repeat the process in the night by splashing the closed eyes 20 times with cold water and then 20 times with warm water. This stimulates the circulation.[14]

DOI: 10.18410/jebmh/2015/1001

Outcome Measures: Finger Dexterity Test (Eye—Hand Coordination): Eye to hand coordination of all the subjects was measured by O" Connor Finger Dexterity apparatus.

O" Connor Finger Dexterity apparatus: This equipment consists of one metal tray, one metal plate, and around 300 metal pins. The metal tray is meant for keeping metal pins. The metal plate consists of 100 holes of depth 0.75 inch made with No. 9 drill. The diameter of each hole is 0.196 inch and is 0.5 inch apart. The metal pins are made of brass of 1 inch in length. Diameter of each pin is 0.072 inch.

METHOD OF USE: Subject is asked to sit comfortably on a chair or stool. The instrument is kept on the table in front of the subject. The height is so adjusted that the subject is comfortable and relaxed while doing the test. Subject is instructed to pick up three pins at a time from 300 pins in the metal tray and to fill them in one hole of the metal plate from one direction to other. The subject is asked to use only one hand. We counted the number of pins and number of holes filled by the subject in one minute before the practice of exercises and after 8 weeks i.e. after doing exercises regularly.

STATISTICAL ANALYSIS: The statistical analysis was done using Data Analysis tool of Microsoft Excel and Systat 12 (Systat Software, Inc. Chicago).The statistical significance was considered at probability value less than 0.05.

RESULTS: The study participants were divided into two equal groups. Thirty subjects each were enrolled in the study and control group with age group of 18–30 years. Both male and female participants were included in the study. Finger dexterity test values in study group before and after intervention were 31±4.94 and 33±4.98 respectively. Whereas in control group the values were 29.9±5.7 and 30.1±5.31 respectively. Student's t test was applied for statistical analysis. Result suggested that there was statistically significant improvement in finger dexterity score in study group participants whereas the results were statistically non-significant in control group subjects. Above findings suggest that practicing pranayama and eye exercises improve eye to hand coordination.

Study Group			
Group	**Mean**	**Std. Dev.**	**SEM**
Before Exercise	31	4.94	0.902
After Exercise	33	4.98	0.909
P value=0.000 (S)			

Table 1: Finger Dexterity test findings in Study group

Control Group			
Group	**Mean**	**Std. Dev.**	**SEM**
Before Exercise	29.90	5.70	1.04
After Exercise	30.10	5.31	0.97
P value=0.489 (NS)			

Table 2: Finger Dexterity test findings in Control group

DOI: 10.18410/jebmh/2015/1001

Group (N=18)	Before Exercise	After Exercise	P Value
Study Group	31.33±5.06	3.17±4.66	P = 0.000(S)
Control Group	30.33±5.9	30.17±5.59	P= 0.6676(NS)
Values are expressed as Mean±S.D			

Table 3: Finger Dexterity findings in Males

Group (N=12)	Before Exercise	After Exercise	P Value
Study Group	30.5±4.93	32.75±5.64	P = 0.0055(S)
Control Group	29.25±5.59	30.00±5.12	P = 0.0819(NS)
Values are expressed as Mean±S.D			

Table 4: Finger Dexterity findings in Females

DISCUSSION: In the present study O" Connor Finger Dexterity test was used to check eye to hand coordination in normal healthy subjects and to see the effect of pranayama and eye exercises on Finger dexterity test. Results suggested that there was significant improvement in eye to hand coordination in subjects practicing pranayama along with eye relaxation exercises as compared with control group.

The finger dexterity test is a fine motor skill task performed to measure eye-hand co-ordination. The improvement seen in the present study might be because of the beneficial effect of kapalabhati on conscious arousal, attention and anxiety based on changes in electroencephalography.[15,16] Attention and anxiety has been reported as predictors of fine motor skills. Thus the betterment in attention and relief from anxiety following kapalabhati pranayama along with eye relaxation exercises as seen above could explain the improvement in finger dexterity in the present study.[17,18]

The results of our study are supported by the earlier studies. Shirley Telles et al. reported that kapalabhati and breathe awareness improved fine motor skills assessed by finger dexterity and visual discrimination.[6] In ADHD children, pranayama might calm the mind and helps in increasing the attention span. It may also absolve and remove distractions from the mind. Because of this, children exhibit improvement after the pranayama practice. Pranayama may improve the functions of the brain cells which ultimately result in the improvement of memory and concentration. It may also augment the finger flexibility and grip strength. Yoga Sana may reduce neurotic tendency, general anxiety, and physiological anxiety & sleep disturbance.[8,19]

Pranayama can have a major soothing effect on children and adults who practice it, calming negative excitable behaviour. It may help individuals in developing a stronger memory, will power, higher levels of concentration and improved respiration and reducing stress. These changes are reflected in the form of improvement of fine motor skills.[20,21,22,23]

The extra ocular muscles need to be adjustable and vitalized so as to maintain clear accurate focus. As we relax, muscles relax. This enables them to return to their natural state and move freely. Vision is a function of body as well as mind. Developmentally the eye is an extension of the brain, and it's the mind that sees. As a result of this body-mind coordination the eyes only relax completely when the mind is relaxed. The mind relaxes when it is focused on just one thing at a time.[24]

CONCLUSION: Results of our study suggest that simple relaxation techniques like kapalabhati pranayama and various eye relaxation techniques improves fine motor skills and concentration depicted by improvement in eye to hand coordination.

REFERENCES:

1. Ernst MO, Bülthoff HH. Merging the senses into a robust percept. Trends Cogn Sci. 2004; 8: 162–9.
2. Sherick CE. Touch as a communicative sense. J Acoust Soc Am. 1985; 77: 218–9.
3. Lederman SJ, Klatzky RL. Extracting object properties through haptic exploration. Acta Psychologica. 1993; 84: 29–40.
4. Grunwald M, editor. Berlin, Germany: Birkhäuser; 2008. Human haptic pereption - basics and applications.
5. Woods JA, Leslie LF, Drake DB, Edlich RF. Effect of puncture resistant surgical gloves, finger guards, and glove liners on cutaneous sensibility and surgical psychomotor skills. J Biomed Mater Res. 1996; 33: 47–51.
6. Shirley Telles, Nilkamal Singh, and Acharya Balkrishna. Finger dexterity and visual discrimination following two yoga breathing practices. Int. J Yoga. 2012 Jan; 5(1): 37-41.
7. Taimini IK. Madras, India: Theosophical Publishing House; 1986. The Science of Yoga.
8. Singh, S., & Singh, J. P. Impact of Pranayama on Fine Moter Coordination Ability of Children with Intellectual Impairment. Creative Education 2014; 5: 273-278.
9. Telles S, Hanumanthaih B, Nagarathna R, Nagendra HR. Improvement in static motor performance following yogic training of school children. Percept Mot Skills. 1993; 76: 1264–6.
10. Telles S, Hanumanthaih B, Nagarathna R, Nagendra HR. Plasticity of motor control systems demonstrated by yoga training. Indian J Physiol Pharmacol. 1994; 38: 143–4.
11. Manjunath NK, Telles S. Factor's influencing changes in tweezer dexterity scores following yoga training. Indian J Physiol Pharmacol. 1999; 43: 225–9.
12. Lynton H, Kligler B, Shiflett S. Yoga in stroke rehabilitation: A systematic review and results of a pilot study. Top Stroke Rehabil. 2007; 14: 1–8.
13. Sharma VK, Das S, Mondal S, Goswami U, Gandhi A. Effect of Sahaj yoga on neuro-cognitive functions in patients suffering from major depression. Indian J Physiol Pharmacol. 2006; 50: 375–83.
14. Nitin B. Gosewade, Vinod S. Shende, Shriniwas J. Kashalika. Effect of Various Eye Exercise Techniques along with Pranayama on Visual Reaction Time: A Case Control Study. Journal of Clinical and Diagnostic Research. 2013 Sept; Vol-7(9): 1870-1873.
15. Joshi M, Telles S. A nonrandomized non-naïve comparative study of the effects of kapalabhati and breath awareness on event-related potentials in trained yoga practitioners. J Altern Complement Med. 2009; 15: 281–5.
16. Stancak A, Jr, Kuna M, Srinivasan, Dostalek C, Vishnudevananda S. Kapalabhati–yogic cleansing exercise. II. EEG topography analysis. Homeost Health Dis. 1991; 33: 182–9.
17. Brossard-Racine M, Majnemer A, Shevell M, Snider L, Bélanger SA. Handwriting capacity in children newly diagnosed with attention deficit hyperactivity disorder. Res Dev Disabil. 2011; 36: 2927–34.

DOI: 10.18410/jebmh/2015/1001

18. Yoshie M, Kudo K, Murakoshi T, Ohsutki T. Music performance anxiety unskilled pianist: Effects of social-evaluative performance situation on subjective, autonomic, and electromyographic reactions. Exp Brain Res. 2009; 199: 117–26.
19. Venkatesh, M. (2005). The Effect of Yoga on the Personality Development of Students. Ph.D. Thesis, Bangalore: Swami Vivekananda Yoga Anusandhana Samsthana.
20. Desikachar, T. K. V. (1987). The Yoga of T. Krishnamacharya. Madras: Krishnamacharya Yoga Mandiram.
21. Jayachandran, P. (1998). Yoga and Physical Training for the Mentally Retarded. The 6th Annual Seminar on Changing Perception on Mentally Retarded, Gwalior.
22. Rawat, G. (2005). Yoga: The Health Mantra. New Delhi: Student Book Depot.
23. Vinod Shende, Satish Waghmare, Sachin Pawar, Shriniwas Kashalikar. Effect of pranayama on blood glucose level in medical students: A case control study. International Journal of Research in Health Sciences. Oct–Dec 2013; 1(3): 209-212.
24. Taylor, D. Alternative eye care. Br J Ophthalmol. 2001; 85: 767–768.

AUTHORS:

1. Nitin Gosewade
2. Vinod Shende
3. Chhaya Saraf
4. Amol Drugkar

PARTICULARS OF CONTRIBUTORS:

1. Associate Professor, Department of Physiology, Chandulal Chandrakar Medical College, Kachandur, Durg.
2. Assistant Professor, Department of Physiology, MGIMS Sevagram.
3. Professor & HOD, Department of Physiology, Chandulal Chandrakar Memorial Medical College, Kachandur, Durg.
4. Associate Professor, Department of Anatomy, Chandulal Chandrakar Memorial Medical College, Kachandur, Durg.

NAME ADDRESS EMAIL ID OF THE CORRESPONDING AUTHOR:

Dr. Vinod Shende,
Assistant Professor,
Department of Physiology,
MGIMS, Sevagram.
E-mail: drvinodshinde@gmail.com

Date of Submission: 22/09/2015.
Date of Peer Review: 23/09/2015.
Date of Acceptance: 03/10/2015.
Date of Publishing: 15/10/2015.