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Original Research Article

Study of effect of visual stimuli on heart rate variability in middle aged males

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ABSTRACT

Introduction: Changes of light intensity can shift many physiological parameters like heart rate variability (HRV). This study is to assess the effect of visual stimuli on cardiac autonomic activity using Heart Rate Variability in middle aged males.
Objectives: To determine the effect of visual stimuli on Heart Rate Variability in middle aged males.
Materials and Methods: The effects of visual stimuli on cardiac autonomic activity using Heart Rate Variability (HRV) was studied in 50 healthy middle aged males. Beat to beat R-R intervals were continuously recorded under closed eye condition (CEC) and the open eye condition (OEC). HRV frequency domain parameters like LF nu, HF nu, LF/HF were obtained with the help of RMS polyrite – D version 3.0.11
Results: The values of LF nu, HF nu and LF/HF for all the subjects under both the closed –eye condition (CEC) and open- eye condition (OEC) were obtained. Values of LF nu and LF/HF under CEC appear to be smaller than those OEC. The mean value of HF nu for under CEC was significantly greater (< 0.05 level) when compared to OEC.
Conclusion: The parasympathetic component of the cardiac autonomic activity increased during the closed eye condition when compared to the open eye condition.

1. Introduction

Human beings are very sensitive to light exposure. Light intensity changes can shift many physiological parameters like melatonin, alertness, body temperature, heart rate (HR), and heart rate variability (HRV).

The stimulation in the sympathetic nervous system increases heart rate and excitation of parasympathetic nervous system reduces heart rate by increasing vagal tone. Physiological responses to environmental stimuli have been investigated intensly.[1,2] Heart rate at rest is regulated through the activity of cardiac autonomic nervous system. HRV is the degree of variation of the heart rate under the balanced influence of sympathetic and parasympathetic components of the cardiac autonomic nervous system. Heart Rate Variability (HRV) is a specific and sensitive non-invasive tool to evaluate cardiac autonomic activity. HRV also indicates the extent of neuronal damage to autonomic nervous system.

This study is done to see that effect of visual stimuli on cardiac autonomic activity using HRV in middle aged males as sudden cardiac death, can be prevented if life style modifications are done.

2. Objectives

To test the effect of visual stimuli on HRV in middle aged males.

3. Materials and Methods

The effects of visual stimuli on cardiac autonomic activity using HRV was studied in 50 healthy middle aged males. Beat to beat R-R intervals were continuously recorded under closed eye condition and the open eye condition. HRV

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frequency domain parameters like LF nu, HF nu, LF/HF were obtained with the help of RMS polyrite – D version 3.0.11

3.1. Ethical clearance

Ethical clearance was obtained from our institution ethical committee and informed consent was obtained from all the subjects.

3.2. Inclusion criteria

Healthy 50 males of middle age group of 45-65 years were included in the study.

3.3. Exclusion criteria

Subjects who are obese or with history of diabetes mellitus, hypertension, respiratory illness, cardiac diseases and endocrinal disorders were excluded. Subjects on any medications were also excluded.

3.4. Statistical analysis

Descriptive statistical analysis has been carried out in the present study. Results on continuous measurements are presented on Mean SD (Min-Max) and results on categorical measurements are presented in Number (%). Significance is assessed at 5% level of significance. Analysis of variance (ANOVA) has been used to find the significance of study parameters between three or more groups of patients, Student t test (two tailed, independent) has been used to find the significance of study parameters on continuous scale between two groups Inter group analysis.

4. Results

This study signifies that closing eyes for a while might help heart by increasing the parasympathetic component of the cardiac autonomic activity and the parasympathetic component of the cardiac autonomic activity increased during the closed eye condition when compared to the open eye condition. The mean value of HF nu for under CEC was significantly greater (< 0.05 level) when compared to OEC.

The values of LF nu and LF/HF under CEC appear to be smaller than those OEC.

Table 1: Basic characteristics of subjects

Variables	Subjects
Age in years	45.14±1.32
BMI (kg/m2)	23.06±0.31

5. Discussion

Summary of findings-This study indicates that the parasympathetic component of the cardiac autonomic activity increased during the closed eye condition when compared to the open eye condition. It signifies that closing eyes for a while might help heart by increasing the parasympathetic component of the cardiac autonomic activity.

C. I. Eastman et al. indicated that light plays a central role in life. Without sunlight there is no life on earth. Effects of light stimulation and light therapy on autonomic functions (e.g., body temperature, HR, or HRV) were already investigated in several human studies.[2]

T. Rechlin et al., showed that changes in automaticity of the pacemaker caused by increased activity of pacemaker caused by increased activity of parasympathetic nerves are rapid due to quick activation of special acetylcholine–regulated K+ channels in the cardiac cells and Decay of the cardiac response is quick due to rapid hydrolyzation of acetyl choline.[3]

Seals DR et al. stated that the cardiac response to increased sympathetic nervous activity is much slower than the response increased parasympathetic activity due to a delayed release of noradrenaline and to mediation via a slow second messenger system.[4]

Litscher D et al indicated that changes in the activity of parasympathetic nervous system can alter heart rate much more rapidly exerting beat –by –beat control of heart rate compared to sympathetic nervous system. LF-HF ratio is sensitive measure of sympathovagal balance.[5]

C. Cajochen et al. showed that increase in LF-HF ratio indicates increased sympathetic activity and decrease in ratio indicates increased parasympathetic activity. HFnu is an index of parasympathetic activity.[6]

N. E. Rosenthal et al in their studies indicated that participants who were exposed to red light (versus a control color) exhibited a decrease in HF-HRV, and this result was associated with worse cognitive performance.[7]

This study mainly emphasizes on the fact that closing eyes for a while might help heart by increasing the parasympathetic component of the cardiac autonomic activity.

Strength and limitations of the study- The present study is focused only at the effect of visual stimuli on the cardiac autonomic frequency domain parameters. The study is limited to one geographical area and confined to one gender of a specific age group.

6. Conclusion

This study signifies that closing eyes for a while might help heart by increasing the parasympathetic component of the cardiac autonomic activity. The parasympathetic component of the cardiac autonomic activity increased during the closed eye condition when compare d to the open eye condition.

Table 2: Comparision of FFT spectrum between CEC and OEC

HRV	CEC	OEC	P value
LF nu	30.624±2.68 (25.609-41.817)	35.949±3.049 (30.609-46.817)	<0.05*
HF nu	69.375±4.085 (58.183-74.391)	64.05±3.04 (53.183-69.391)	<0.05*
LF/HF	0.446±0.06 (0.344-0.718)	0.568±0.08 (0.441-0.88)	<0.05*

Values Mean ± SD
(Range of data)
*Highly significant

7. Scope for further study

Present study can be expanded in comparing the effect of auditory stimulus on the cardiac autonomic frequency domain and time domain parameters in a various environmental and geographical conditions, in other gender, in different age groups, during meditation and yoga, which involves closure of eye for obtaining more clarity on the relation of these stimuli on heart rate variability.

8. Source of funding

None.

9. Conflict of interest

None.

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