EXAM STRESS AND CHOICE REACTION TIME IN FIRST YEAR MEDICAL STUDENTS

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ABSTRACT

BACKGROUND

Medical education has always been regarded as highly stressful to students. The same stressors may be perceived differently by different medical students, depending on their cultural background, personal traits, experience and coping skills. Exam stress, inordinate hours, sleep deprivation, excessive workload, helplessness, increased psychological pressure, mental tension, adds to the stress of medical students. Reaction time is an index of sensory motor performance. Exam stress affects cognitive function.

The aim of the study is to find the effect of exam stress on auditory and visual reaction time in first year medical students.

MATERIALS AND METHODS

The study group consists of 63 healthy first year medical students of both genders in the age group of 18-20 years. The time between the auditory and visual stimulus given and response of the subject from the sensor will be taken as reaction time. The auditory and visual reaction times were recorded before and after the exam period. Statistical analysis of the data was done by using paired 't' test.

RESULTS

There was significantly prolonged visual and auditory reaction time values before exam on comparison with baseline stress free period. On comparing the same values between females and males also, the results were statistically significant. Exam stress affects the cognitive performance of the students. Prolongation of auditory and visual reaction time reflects the same in our study. Optimal stress relievers are needed in student life to cope with stress and ease out the stressful periods like exam stress.

CONCLUSION

1. Exam stress affects the cognitive performance of the students.
2. Prolongation of auditory and visual reaction time reflects the same in our study.
3. Optimal stress relievers are needed in student life to cope with stress and ease out the stressful periods like exam stress.

KEYWORDS

Stress, Reaction Time, Medical Students.

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BACKGROUND

Stress is defined as the body's nonspecific response or reaction to demands made on it, or to disturbing events in the environment.[1,2] It is a process by which we perceive and cope with environmental threats and challenges.[3] Personal and environmental events that cause stress are known as stressors.[4,5]

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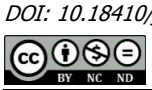

Medical education has always been regarded as highly stressful environment to students.[6,7] Stress in medical students can affect the physical and psychological well-being of the students.[8] Linn and Zeppa stated some stress in medical school training is needed for learning.[9] Stress which promotes and facilitates learning is called "favourable stress" and stress which inhibits and suppresses learning is called "unfavourable stress". They are also denoted as "Eustress" and "Distress". Eustress is attributed to positive outcome whereas distress is mostly correlated with negative outcome. Extreme magnitude of distress can cause burnout in many instances. The same stressors may be perceived differently by different medical students, depending on their cultural background, personal traits, experience and coping skills. Various studies conducted among medical students have reported prevalence of stress ranging from 27-73%.[10] Exam stress, inordinate hours, sleep deprivation, excessive workload, helplessness, increased psychological pressure, mental tension, adds to the stress of medical students. It is

observed that high stress causes deterioration in the academic performance of students.

Reaction time is the interval of time between application of a stimulus and detection of a response.[11] Reaction time is an index of sensory motor performance. Reaction time is a valid and easy method of analysing the cognitive function of the individual. Exam stress affects cognitive function.[12,13,14] The present study is designed to find the effect of exam stress on reaction time in first year medical students.

MATERIALS AND METHODS

The study was approved by Institutional Ethics Committee. The sample size was calculated on the basis of expecting a standard deviation of 10, Zα for α error of 5% as 1.96, Zβ for β error of 20% (power of 80%) as 0.84 and expecting a mean difference of 5 as 63. The study was conducted on 63 healthy first year MBBS student volunteers of both gender between the age group of 18 and 20 years. There were 49 female students and 14 male students in the participants. The participation to the study was made purely voluntary to the students. The subjects who were suffering from colour blindness, hearing impairment and sensory-motor disability were excluded from the study. As auditory and visual reaction time are prolonged in luteal phase[15,16] and menstrual phase,[17] the study group of females in the current study was included on mid follicular phase to keep the data unbiased. Informed consent was taken from all the subjects after they receive verbal explanation of the nature of the study.

The study was performed using the help of digital discriminatory and choice reaction time apparatus manufactured by Anand agencies, Pune. The study was performed in the same time of the day for all the participants to avoid influence of circadian rhythm. The volunteer was taken to the research lab which had optimal lighting and sound attenuated environment for better results of the study.

In this study a choice reaction time in the form of visual (red or green light) and auditory signals (high or low pitch sound) were used. The examiner sits with master (primary) controls and participant sat on other side with secondary controls. Once the unit is switched on, the examiner presents either with visual (red or green lights) or auditory signals (high & low pitch sounds) to the subject at random. Now, the subject immediately responded by releasing the corresponding switch on his/her side. The time duration between the application of stimulus by examiner and the response from the subject is the reaction time, which is recorded on reaction time apparatus in milliseconds. Ten such test recordings were done after two to three practice sessions. The lowest of these recordings were taken as final reaction time value for each subject. One set of recordings were taken in 'stress free' condition i.e. when the student was not under the stress of any upcoming exam and the second set of recordings were taken 30 minutes before the internal examination. Statistical analysis was done with the help of Microsoft Excel. After calculating the mean and standard deviation and confirming that the data was uniformly distributed, parametric test students' paired t test was used to compare the results. P value less than 0.05 was taken as statistically significant.

RESULTS:

The tables show the visual and auditory reaction time.

Reaction Time	During Stress free Period (m. sec.)		Before Exam (m. sec.)		P
	Mean	SD	Mean	SD	
Visual reaction time	110.1	11.3	124.5	5.3	0.0074
Auditory reaction time	81.9	10.7	103.1	10.0	0.01

Table 1. Visual and Auditory Reaction Time During Stress Free Period and Before Exam

Reaction Time	During Stress Free Period (m. sec.)		Before Exam (m. sec.)		P
	Mean	SD	Mean	SD	
Visual reaction time	111.6	11.3	124.7	5.2	0.0041
Auditory reaction time	81.8	10.5	101.9	10.5	0.0033

Table 2. Visual and Auditory Reaction Time During Stress Free Period and Before Exam for Females

Reaction Time	During Stress Free Period (m.sec.)		Before Exam (m.sec.)		P
	Mean	SD	Mean	SD	
Visual reaction time	104.9	10.2	123.9	5.7	0.017
Auditory reaction time	82.0	11.8	107.1	6.8	0.0049

Table 3. Visual and Auditory Reaction Time During Stress Free Period and Before Exam for Males

Considering the participants as single entity, there were significantly prolonged visual and auditory reaction time values between normal baseline stress free period and before exam. The difference in the readings during stress free and exam stress condition were statistically significant. On comparing the same values between females and males also, the results were statistically significant.

Both, visual and auditory reaction time were significantly prolonged for males and females enforcing that under stress full situation, the reaction time – the indicator of sensory-motor coordination is challenged by prolongation of these parameters.

DISCUSSION

The exam stress is a known acute stressor. Medical education also generates lots of stress in medical students. The volume of the subject, migration from school curriculum to college curriculum, introduction to new environment, peer adjustment, difference in study style, moving away from home etc. all lead to enormous stress in medical students. Added to these in addition to exam stress, the practical viva session is still more stressful, as the student has to face the examiner directly and answer. Particularly, the first-year students are more prone for this stress, as all together this is a new experience to them.

The aim of the present study was to observe the effect of exam stress on visual and auditory reaction time in medical students. It was observed that visual and auditory reaction time does get prolonged significantly when the students were exposed to exam stress as compared to stress free condition.

Reaction time is defined as an interval between the application of a stimulus to the appearance of appropriate voluntary response in a subject. Luce and Welford[18,19,20] described reaction time as simple reaction time and choice reaction time.

In simple reaction time, a single stimulus is presented with single voluntary response to it. In choice reaction time, more than one stimulus are presented and the subject is required to discriminate and respond accordingly. In our study we have used choice reaction time estimation. Either a red or green light is presented to the participant at random. The participant has to react by toggling the corresponding switch on his/her side. The minimal of ten trials was measured as the visual reaction time for that particular participant. Similarly, the auditory reaction time between a tone and click sound was measured.

This choice reaction time includes mental processing time and movement time.[13] Mental processing time involves time required by participant to perceive stimulus, identify, analyse and decide proper motor response. Movement time involves time required to perform the movement after selection of response. So, choice reaction time is a complicated process which involves recognition, discrimination, and analysis of stimulus and decision making for appropriate response selection. Reaction time is used as a cognitive test to measure the information processing speed.[21] Cognitive function reflects an individual's ability to think and reason in terms of temporal and spatial relationships and in symbols such as words and number. Simple reaction time test is usually considered a psychomotor test which refers to an individual's ability to co-ordinate timely and appropriate responses to stimuli but if the stimuli are complex and require decisions about how to respond then the test becomes more cognitive.[22]

In our study we decided to use choice reaction time as it reflects cognitive function of the individual. The results of our study show that, both visual and auditory reaction time is prolonged whenever the student in under exam stress. On comparing mean and standard deviation, during exam stress, the students showed prolonged reaction time. This prolongation is statistically significant on subject to student's paired t test.

Comparing among the males and females, females showed more prolonged visual reaction time during exam stress than males and males showed more prolonged auditory reaction time than females during exam stress.

The results show that exam stress affects the cognitive functions of students. Physiologically, this result can be explained on the basis of influence of hypothalamo-hypophysial-adrenal axis on higher functions. The stress, through hypothalamo-hypophysial-adrenal axis cause more cortisol and stress hormones like catecholamines to release which act on prefrontal cortex of the brain. Actions of glucocorticoid and catecholamines on pre-frontal cortex lead to a hyperdopaminergic response.[23,24] These neurochemical changes impair pre-frontal cortex signaling and neurotransmission during periods of stress and compromise pre-frontal cortex functions, thus affecting cognition and behaviour.[25]

Our results were consistent with the work done by Parikshit et al which also showed an increase in reaction times during exam stress in medical students.[13] Ganesh et al showed not only reactions times but also pulse rate, blood pressure and stress scores were increased in pre-examination settings among first year medical students irrespective of gender.[26]

So, the performance reduces because of acute exam stress. But this stress is unavoidable, and students have to undergo this stress for promotion to further years. So, we suggest, relaxation techniques like yoga, meditation, optimal sports and extra-curricular activities, break from regular work and early-well-planned preparation schedule will help in great for students to ease out their exam stress and perform well in the exams. Preparing the subjects regularly on day-to-day basis irrespective of exams, counselling and having campus mentor program will also help in overcoming the stressful situation.

CONCLUSION

1. Exam stress affects the cognitive performance of the students.
2. Prolongation of auditory and visual reaction time reflects the same in our study.
3. Optimal stress relievers are needed in student life to cope with stress and ease out the stressful periods like exam stress.

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