Correlation of Stress and Work Load in Dental Students during Clinical Academic Years

Carolina Duarte, Hala Zakaria, Eman Mahdi, Shato Othman, Noura Ali
RAK College of Dental Sciences, RAK Medical and Health Sciences University, Al Qusaidat, Ras Al Khaimah, United Arab Emirates

Abstract

Context: Stress produces physical and mental effects that can affect student academic performance, social interactions and overall quality of life. Identification and treatment of stressed individuals are necessary during clinical training. Aims: The purpose of this study was to assess and correlate the perceived stress levels and work load observed in dental students. Subjects and Methods: Students were assessed using the Perceived Stress Scale and Effort-Reward Imbalance questionnaires to evaluate the level of general stress and academic-related work load/satisfaction, respectively. Data was collected before, during and after examinations in students from the third to fifth year of the BDS programme. Results: The perceived stress was correlated primarily with student’s effort and commitment, and increased with academic progression. Changes in blood pressure or body temperature did not correlate with stress in a consistent manner. Perceived stress was significantly higher during examination periods while the effort-reward index was higher in students before or after examinations. Few students were classified as being stressed or dissatisfied significantly more than what was considered normal for their peers. Conclusions: Stress experienced by dentistry students may be greatly influenced by their effort and commitment. The level of stress experienced may not be severe enough to produce a physical response that may affect overall health; however, some students may experience periods of stress or dissatisfaction that are significantly higher than the norm and may be at risk of burnout. The stress scores and effort-reward indexes had a tendency to increase with academic progression and with demanding academic periods.

Keywords: Academic workload; effort, reward, stress

Introduction

Healthcare careers are known to carry with them significant amounts of stress, which is experienced by both professionals and students. Stress and anxiety in health-care universities have been widely studied. Previous studies have pinpointed excessive workload, lack of feedback during training, uncertainty of future competence, non-supportive environments, high parental expectations, sleeping disorders and loneliness as the major factors leading to stress in these students. Stress and loss of motivation in health-care professionals and students tend to be higher during the 1st year of university training with increasing reports of stress during the period of transition to clinical training and higher prevalence in females than that in males and during demanding periods such as examinations.

A variety of therapeutic practices have been suggested to treat stress-related mental health issues and burnout. Some therapeutic approaches that have been used and studied in health-care professionals and students include cognitive behavioural therapy, exercise therapy, mindfulness, stress management techniques, yoga and meditation. The effectiveness of these methods is variable and dependent on multiple factors specific to each studied group. The physical and mental effects of stress can affect student academic performance, social interactions and overall quality of life; therefore, its prevalence and severity in health-care students should be acknowledged in order to efficiently control it.

A number of studies have focused on the identification of stressors and stressful periods for timely intervention; however, not as many studies have used structured validated...
questionnaires for these assessments. The level of stress can be examined through questionnaires such as the ‘Perceived Stress Scale’, ‘work-related behaviour and experience pattern’ or ‘Beck’s depression inventory’. Physical signs of stress including muscle activity, salivary cortisol levels, blood pressure, body temperature (BT) and brain impulses can also be quantified; however, the quantification of these signs is sensitive and significant variations are hard to detect.[14,15] The perceived workload and social reciprocity can be effectively measured using the effort-reward imbalance (ERI) model, a measurement of how failed reciprocity in terms of high efforts spent and low rewards received, in turn, is likely to elicit sustained stress responses.[16]

The purpose of this study was to determine at which academic stages and specific moments in the academic year, the workload will be a determinant of stress. The study focussed on the association of stress and academic workload using structured questionnaires to target one isolated factor that has been proven to be a stressor. The approach utilised provided more specific data than that obtained with open or multiple factor questionnaires. The data collected have been sorted into different academic stages with different workloads and evaluation processes and have used a demanding period of the study that has been proven to spike stress levels to obtain contrasting figures. This study will clarify the effect of a specific factor in a determined academic group at a particularly stressful period in order to better address burnout risk. The purposes of this study were to assess, with high specificity, the prevalence of perceived stress and academic load in dental students and to examine the correlations between stress, academic workload and physical signs of stress.

Subjects and methods

Subjects

Fifteen students from the last three academic years of the 5 years bachelor of dental surgery programme were included in this study. Students from the 1st and 2nd years were excluded as they do not engage in preclinical or clinical activities. Students who were currently undergoing or had undergone mental health problems were excluded from this study. Students with systemic conditions that could affect their perceived stress, or their blood pressure and BT were also excluded from this study. A total of 45 students were used as the study sample. The sample was divided into three groups of 15 students each from the 3rd-, 4th- and 5th years.

Procedure

A cross-sectional study was conducted on students from RAK College of Dental Sciences after institutional ethical approval of the research methodology was obtained (RAKHSU-REC-9-2015-UG-D). Students were assessed using two internationally recognised questionnaires, Perceived Stress Scale (PSS)[2,3] and ERI,[16] to evaluate the level of perceived general stress and work-related stress, respectively. PSS assesses the degree to which participants evaluate their lives as being stressful during the past month using a ten-item questionnaire answered through Likert scales for each individual item. The questionnaire was adjusted to evaluate stress during the 15 days before the survey. ERI is a 10-item questionnaire that assesses the demanding aspects of the work environment. It evaluates the effort reportedly made and the rewards obtained from this effort. An additional set of six items evaluate the level of commitment and personal sacrifice done by the subject, as well. The ERI questionnaire uses Likert scales to weigh each question.

Data were collected at three-time points that can be considered relevant to stress level variations. The first set of data was collected 15 days before university examination period (T1), the second set was collected during the examination period (T2) and the last set was collected 15 days after examination period (T3). The questionnaires were given to the students in a quiet, well-illuminated and well-ventilated room at a constant 23°C. The students remained undisturbed until the questionnaires were completed.

The perceived stress score was calculated by adding the values given by the subject to each of the PSS items to obtain the total perceived stress score (PS). The higher the PS, the more stress the subject reports to be. The questions regarding effort, rewards or commitment are added separately. The ERI index (ER) value for each individual was calculated from the sum of the effort and reward items using the following formulas: ER = K (E/R) where K = number of reward items/number of effort items. The items regarding commitment were not used for the ER calculations but were used in the analysis.

Prior to answering the questionnaires, the student’s blood pressure and BT were recorded using a digital blood pressure monitor and a digital thermometer. The blood pressure was measured in ‘mm Hg’ by the same operator three times for each subject and averaged to obtain the measurement used for analysis at each time point. The BT was measured in Celsius using an ear digital thermometer with disposable tips.

Analysis

The scores for PS and ER were analysed using descriptive statistics to calculate means and standard deviations. The normal PS and ER were calculated adding one standard deviation to the mean to get the higher level and by subtracting one standard deviation from the mean to get the lower level. Subjects reporting values that were above one standard deviation from the mean were considered moderately more/less stressed/dissatisfied; and those reporting values above two standard deviations from the mean were considered severely more/less stressed/dissatisfied. The correlations between PS, blood pressure, BT and the different components of the ER were assessed using Pearson’s correlation. A positive correlation indicated that both factors increased or decreased at the same time, whereas a negative correlation indicated that as one factor increased, the other factor in the comparison decreased. An R < 0.40 was considered low; 0.40–0.60 was
considered a moderate correlation; 0.6–0.8 was considered a significant correlation; and 0.80–1.00 was considered a highly significant correlation. The values obtained for PS and ER for the different groups and the different time points were summarised and compared using repeated measures analysis of variance (rANOVA) followed by Bonferroni correction. The values of $P < 0.05$ were considered statistically significant.

**RESULTS**

The average age for the 3rd-, 4th- and 5th-year students included in this study was 20.53 (±0.52), 21.93 (±3.10) and 24.13 (±2.36), respectively. The total gender distribution was not significantly different except in 3rd-year students, where more females remained in the study. This was partially affected by a greater overall female population in the institution and a greater disposition from female students to contribute to the study.

The stress levels reported by students were associated with the amount of effort made, rewards obtained and the level of commitment from the students [Table 1]. Stress was positively correlated to effort in 3rd-year and 5th-year students before and during examination periods. The correlation was moderate in 3rd-year students but significant in the 5th-year students. The amount of effort made by students causes them stress, which increased with academic progression. Stress is negatively correlated to rewards after examination in 3rd-year students. The lack of compensation increased the levels of stress in younger students. Stress is positively correlated to the level of commitment in 4th-year students before and after examination and in 5th-year students throughout the three study periods. The correlation is moderate for both groups after examination but significant before examinations. The correlation is also significant in 5th-year students during examination. The stress associated with student dedication increased with academic progression, which could be related to the greater clinical exposure experienced by 4th- and 5th-year students. A moderate positive correlation was observed between stress and BT in 3rd-year students before examination, and a moderate negative correlation was observed between stress and blood pressure in 5th-year students after the examination period.

The variation of PSS and ERI within individuals and during the three study periods was observed after applying the rANOVA. Third-year students showed more significant individual changes in ERI ($P = 0.0001$) than PSS ($P = 0.0367$). Fourth-year students had more significant individual variations in PSS ($P = 0.0001$) than ERI ($P = 0.0029$). Fifth-year students had equally significant individual differences in PSS ($P = 0.0001$) and ERI ($P = 0.0001$). Third-year students experience more changes in satisfaction levels than stress levels whereas 4th-year students experience more changes in stress levels than satisfaction levels. Fifth-year students showed consistent individual variations in both stress and satisfaction. PSS is more significantly dependant on time (T1-T2-T3) than ERI in 3rd- and 4th-year students; however, both PSS and ERI are equally significantly dependant on time in 5th-year students [Table 2].

The mean perceived stress scores were higher in 5th-year students at all studied periods but were only significantly higher in 5th-year students than in 3rd-year students, before examination period [Figure 1]. Stress during examination was significantly higher than before examination in the 3rd- and 4th-year students. Stress during examination period

| Table 1: Correlations between the studied factors |
|---|---|---|---|
| Factors | Period | R.Value |
| TPSS-Effort | T1 | 0.4038 | 0.2679 |
| | T2 | 0.4268 | 0.7591 |
| | T3 | -0.0215 | 0.3336 |
| TPSS-Reward | T1 | -0.1704 | -0.2710 |
| | T2 | 0.0710 | 0.0043 |
| | T3 | -0.6706 | 0.3081 |
| TPSS-Commitment | T1 | 0.2685 | 0.7485 |
| | T2 | -0.0430 | 0.6420 |
| | T3 | -0.0250 | 0.5427 |
| TPSS-BP | T1 | 0.2137 | 0.4222 |
| | T2 | 0.1024 | -0.2937 |
| | T3 | -0.1462 | 0.4508 |
| TPSS-BT | T1 | 0.4052 | 0.3534 |
| | T2 | 0.0683 | 0.3461 |
| | T3 | -0.1077 | 0.1873 |

| Table 2: Variation of stress and effort-reward within subjects and between study periods |
|---|---|---|---|
| Factor | Grade | PSS | ERI |
| Individual | 3rd | 0.0367 | 0.0001 |
| | 4th | 0.0001 | 0.0029 |
| | 5th | 0.0001 | 0.0001 |
| Study period | 3rd | 0.0001 | 0.0187 |
| | 4th | 0.0001 | 0.0046 |
| | 5th | 0.0214 | 0.0273 |

**Figure 1:** Total perceived stress scores. The PS was significantly higher in 5th-year students than in 3rd-year students before examination (T1). Stress during examination (T2) was significantly higher than before examination (T1) in 3rd- and 4th-year students and significantly higher than after examination period (T3) in 3rd, 4th and 5th-year students. PS: Total perceived stress score, BP: Blood pressure, BT: Body temperature.
was significantly higher than after examination period in 3rd-, 4th- and 5th-year students, as expected.

A high effort-reward index implies that the subject believes that a higher effort is input to an activity that does not result in an equally quantifiable amount of reward. An ER of one means that the subject believes that the amount of effort made and rewards obtained are equal and balanced. The mean ER was higher in 5th-year students at all studied periods but was only significantly higher in 5th-year students than in 3rd- and 4th-year students during examination [Figure 2]. Fifth-year students consider their efforts to be ill rewarded significantly more than 3rd- and 4th-year students during examination. The imbalance between the effort done and the rewards obtained from that effort where significantly higher after examination than before and during examination in 4th-year students. In contrast, the imbalance was significantly higher during examination than after examination in 5th-year students.

The normal PSS scores before, during and after examination period were 12–20, 19–25 and 12–23, respectively, for 3rd year

---

**Figure 2:** Effort-Reward Index. The mean ER was significantly higher in 5th year students than in 3rd and 4th year students during examination (T2). It was significantly higher after examination (T3) than before (T1) and during examination (T2) in 4th year students, but significantly higher during examination (T2) than after examination (T3) in 5th year students. The red dotted line marks ER = 1, where the reported amount of effort is equal to the rewards received.

**Figure 3:** Total perceived stress score distribution. The PS values were more disperse in fifth year students at all the studied periods. A larger number of subjects reported scores that were notably higher than their peers. Black diamonds, values within one standard deviation from the mean; white diamonds, values more than one standard deviation away from the mean; white triangles, values more than two standard deviations away from the mean.
students; 14–23, 20–24 and 14–21, respectively, for the 4th year students; and 14–31, 18–33 and 12–29, respectively, for 5th-year students. The perceived stress scores were more disperse in 5th-year students at all the studied periods [Figure 3]. A greater number of 3rd-year students reported scores that were moderately more stressed than their peers and few reported scores that were moderately less stressed than their peers. In 4th- and 5th-year students, comparable numbers of subjects reported scores that were moderately more or less stressed than their peers. Students who were extremely stressed were only observed in the 3rd-year students group, whereas some students who were extremely relaxed were observed in the 4th and 5th years.

The normal ER values before, during and after examination period were 0.77–1.20, 0.89–1.30 and 0.79–1.22, respectively, for 3rd-year students; 0.83–1.15, 0.86–1.09 and 0.88–1.42, respectively, for the 4th-year students; and 0.93–1.38, 1.02–1.53 and 0.86–1.40, respectively, for 5th-year students. The tendency in the studied sample is for more subjects to be moderately more dissatisfied [Figure 4]. A greater number of students believe that their efforts have not been rewarded when compared to their peers. During examination, the 4th- and 5th-year students were the only ones to report a greater number of moderately less dissatisfied students. Students who were extremely satisfied were observed in the third and 5th-year student groups, whereas students who were extremely dissatisfied were only observed in the 4th year.

**Discussion**

The results observed in this study suggest that work-related stress can be observed in students at different academic stages with a significant increase toward the last year in university. This stress can be directly associated with the student’s effort and commitment to the academic programme. The levels of stress experienced by the students in this sample do not affect blood pressure or BT in a consistent manner, which suggests that the physical effects of stress are not expected. The greatest variation of perceived stress is expected during the examination periods. Dissatisfaction can be experienced by students during or after examinations with the assumption that this phenomenon may be associated with the delivery of feedback. Few students were classified as being stressed or dissatisfied significantly more than what was considered normal for their peers.
Our sample showed few students with higher than average stress scores in general, and the highest proportion of highly stressed students belonged to 3rd- and 5th-year student groups. The upward trend of stress levels from the first to the final year has been observed in previous studies. Students involved in clinical activities and especially during clinical transition periods report higher levels of stress. In our sample, the 3rd-year students who were transitioning into clinical courses were not significantly more stressed as a group but showed a notable number of students who were moderately and extremely more stressed than average. The 5th-year students were significantly more stressed than the rest and also showed an observable number of individuals who were moderately more stressed than average. Some of the factors that may influence the 5th-year student group outcomes are the increase in autonomy and decision-making as the students’ progress in the programme as well as their involvement in research.

Stress increases significantly during highly demanding periods such as examinations. Only 5th-year students did not report significantly increased stress from T1 to T2, which could be due to the 5th-year student’s increased clinical work and decreased lecture load that results in fewer written examinations during the examination period. Student dissatisfaction increased after examination period in the 3rd- and 4th-year students but was greater during examination for 5th-year students. This could be the result of 5th-year students receiving feedback during the clinical examination, or of general dissatisfaction with the objective structured clinical examinations that is common in health-care programmes. Fourth-year students have, along with clinical examinations, a significant load of lectures and written examinations that provide feedback only after the evaluation period which could have caused the different results between the 4th- and 5th-year students. The 3rd-year students seemed to have been confident during examination but may have been disappointed after the evaluation period when feedback was provided.

The limitations of this study include a limited number of students who could adhere to the three-period assessments and the use of structured questionnaires. Structured questionnaires are a reliable standardisation method but do not give subjects the possibility to include details of their experience. A significant correlation of blood pressure and BT stress was observed in this study, as has been observed in the expression of salivary biomarkers. This could be due to the degree of sensitivity and specificity of physical signs of stress. The student graded point average was not a consideration in this study; however, it has been reported that it does not significantly correlate to stress.

**Conclusions**

Stress experienced by dentistry students may be greatly influenced by the input effort and commitment. The level of stress experienced may not be severe enough to produce a physical response that may affect overall health. However, some students may experience periods of stress or dissatisfaction that are significantly higher than the norm and may be at risk of burnout.

**Ethical statement**

The study was approved by the institutional Research Ethics Committee of RAK Medial and Health Sciences University (RAKMHSU-REC-9-2015-UG-D).

**Declaration of participant consent**

The authors certify that they have obtained all appropriate participant consent forms. In the form, the participants have given their consent for the data extracted from their answers to the questionnaires and records of their vital signs to be reported in the journal. The participants understand that their names and initials will not be published and that due efforts will be made to conceal their identity.

**Financial support and sponsorship**

This study was financially supported by RAK College of Dental Sciences.

**Conflicts of interest**

There are no conflicts of interest.

**References**

1. Williams ES, Konrad TR, Scheckler WE, Pathman DE, Linzer M, McMurray JE, et al. Understanding physicians’ intentions to withdraw from practice: The role of job satisfaction, job stress, mental and physical health. Health Care Manage Rev 2001;26:7-19.
2. Dyrbye LN, Thomas MR, Shanafelt TD. Systematic review of depression, anxiety, and other indicators of psychological distress among U.S. And Canadian medical students. Acad Med 2006;81:354-73.
3. Dahlén M, Jonbørg N, Runeson B. Stress and depression among medical students: A cross-sectional study. Med Educ 2005;39:594-604.
4. Schnittner M, Lidl M, Beck J, Rammelsberg P. Chronic stress in medical and dental education. Med Teach 2008;30:97-9.
5. Shah M, Hasan S, Malik S, Sreeramareddy CT. Perceived stress, sources and severity of stress among medical undergraduates in a Pakistani medical school. BMC Med Educ 2010;10:2.
6. Alhajj MN, Khader Y, Murad AH, Celebic A, Halboub E, Márquez JR, et al. Perceived sources of stress amongst dental students: A multicountry study. Eur J Dent Educ 2018;22:258-71.
7. Stucky ER, Dresselhaus TR, Dollard A, Shively M, Maynard G, Jain S, et al. Intern to attending: Assessing stress among physicians. Acad Med 2009;84:251-7.
8. Volmer E, Kieschke U, Schwappach DL, Wirsching M, Spahn C. Psychosocial health risk factors and resources of medical students and physicians: A cross-sectional study. BMC Med Educ 2008;8:46.
9. Sarid O, Anson O, Bentov Y. Students’ reactions to three typical examinations in health sciences. Adv Health Sci Educ Theory Pract 2005;10:291-302.
10. Ng V, Koh D, Mok BY, Chia SE, Lim LP. Salivary biomarkers associated with academic assessment stress among dental undergraduates. J Dent Educ 2003;67:1091-4.
11. Snaith N, Schultz T, Proeve M, Rasmussen P. Mindfulness, self-compassion, anxiety and depression measures in South Australian yoga participants: Implications for designing a yoga intervention. Complement Ther Clin Pract 2018;32:92-9.
12. Pospos S, Young IT, Downs N, Iglewicz A, Depp C, Chen JY, et al. Web-based tools and mobile applications to mitigate burnout, depression, and suicidality among healthcare students and professionals: A systematic review. Acad Psychiatry 2018;42:109-20.
13. Ochentel O, Humphrey C, Pfeifer K. Efficacy of exercise therapy in persons with burnout. A systematic review and meta-analysis. J Sports Sci Med 2018;17:475-84.
14. Alonso JF, Romero S, Ballester MR, Antonijoan RM, Mañanas MA. Stress assessment based on EEG univariate features and functional connectivity measures. Physiol Meas 2015;36:1351-65.
15. Tosato Jde P, Caria PH, Gomes CA, Berzin F, Politti F, Gonzalez Tde O, et al. Correlation of stress and muscle activity of patients with different degrees of temporomandibular disorder. J Phys Ther Sci 2015;27:1227-31.
16. Li J, Shang L, Galatsch M, Siegrist J, Müller BH, Hasselhorn HM, et al. Psychosocial work environment and intention to leave the nursing profession: A cross-national prospective study of eight countries. Int J Health Serv 2013;43:519-36.
17. Tangade PS, Mathur A, Gupta R, Chaudhary S. Assessment of stress level among dental school students: An Indian outlook. Dent Res J (Isfahan) 2011;8:95-101.
18. Botelho M, Gao X, Bhuyan SY. An analysis of clinical transition stresses experienced by dental students: A qualitative methods approach. Eur J Dent Educ 2018;22:e564-e572.
19. Guthrie S, Lichten CA, Van Belle J, Ball S, Knack A, Hofman J. Understanding mental health in the research environment: A rapid evidence assessment. Rand Health Q 2018;7:2.
20. Shahzad A, Saeed MH, Paiker S. Dental students’ concerns regarding OSPE and OSCE: A qualitative feedback for process improvement. BDJ Open 2017;3:17009.