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Academic distress, perceived stress and coping strategies among dental students in Saudi Arabia



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Abstract Objectives: To evaluate the sources of stress among students in the dental school environment, their perceived levels of stress and effective coping strategies.

Methods: This study was conducted during the first semester of the academic year, 2009–10, at the College of Dentistry, King Saud University, Saudi Arabia. The eligible study group consisted of 556 undergraduate dental students from all five class years; they were surveyed with a detailed assessment tool. The validated and translated questionnaire comprised the modified version of the dental environmental stress (DES) survey, the perceived stress scale (PSS) and the brief coping scale (BCS).

Results: The overall findings substantiated with multiple regression indicate that, out of 20 factors of both DES and BC instruments, six factors were significantly and independently related to perceived stress scores ($F = 34.638$; $p < 0.0001$). Especially, the factors self-efficacy and workload of DES and the factors behavioral disengagement, denial, positive reframing and venting of BC were positively and independently related to perceived stress scores.

Conclusions: Dental students displayed relatively high perceived stress scores. Female, advanced and married, compared with male, junior and single students reported more stress. Changes in certain environmental factors and coping strategies independently affected the perceived stress score. Strategies for stress management must be incorporated into dental education to ensure the output of effective dentists.

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1. Introduction

Stress has now become an ingrained part of our vocabulary and daily existence. Originating a little more than 50 years ago the term is now in popular parlance. *Stress*, as coined by Hans Selye in the early 1930s, is a biopsychosocial model that refers to the consequence of failure of an organism to respond adequately to mental, emotional or physical demands, whether actual or imagined (Selye, 1982). The dental training curriculum demands that students master multiple domains of not

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only theory but also clinical proficiencies and patient-relation protocols (Rajab, 2001), resulting in a strenuous lifestyle affecting one's physical and mental well-being. A recent report from the British Association for Counseling and Psychotherapy states that stress-induced emotional imbalance has been on the rise during the past few decades among the student population. The number requiring intervention by therapists has also increased considerably. However, the prime focus remains on what determines the ability of a few students to cope with stressors while others succumb to stress in the dental learning environment.

According to Selye (1982), the proper evaluation of dental environmental stress includes three essential components. External components are the dental environmental stressors. Internal components are the physiological and biochemical factors in one's internal environment (body), the perceived stress. The cognitive responses resulting from the interaction between these two components are the coping strategies that constitute the third component. Scientific evidence shows the multifactorial nature of stress among students, thus making its assessment difficult. Apart from excellence in academic performance, the precise technical requirements of dentistry make the transition from preclinical to clinical all the more stressful (Pau and Croucher, 2003; Radcliffe and Lester, 2003).

Goldstein (1979) initiated a stress study in dental schools following which there was development and refinement of several questionnaires by Garbee et al. (1980). The best of all accounts, in terms of consistency, was the one framed by Grandy et al. (1984a) in the dental environmental stress (DES) questionnaire that includes a clear distinction of eustress from distress. Perceived stress is the appraisal of potentially threatening life events by an individual, being influenced by his or her attitudes and beliefs (Tedesco, 1986). Perfectionism, fueled by past academic achievements and future scholastic expectations, is reported as a major cause of perceived stress in preclinical students (Atkinson et al., 1991). Stress can be physiological only if it stays within a certain limit beyond which it advances to the stage of distress.

Folkman and Lazarus (1980) defined coping as a cognitive and behavioral effort taken by individuals to try to either alleviate or appreciate the requirements creating the disparity between the person and the coexisting environment (Firth, 1986). Their primary suggestion included an in-depth analysis of the determinants leading to stress and their strategic management protocols. They envisioned coping as being either problem-focused or emotion-focused. Ultimately, the etiology of this pandemic stress in dental education requires evaluation for complexity and eradication in the near future. Apparently, the efficacy of the coping modality adopted depends on an individual's perception of stress and his or her inherent desire for quality of life.

Earlier studies evaluating stress were largely limited to documenting either perceived stress, sources of stress or the coping strategies in the dental environment as separate entities. One possible concern over such an approach would be the lack of coherence in establishing the sources, perseverance and remedies for stress in the dental curriculum. Thus, our prospective research utilizing a comprehensive battery of instruments evaluated all aspects of the stress study. We envisioned that such an approach could validate our outcome, analyzing the students' perceptions of the dental program and their concurrent coping with stress through 5 years of academics.

2. Materials and methods

2.1. Participants

All undergraduate dental students in their first to fifth years as of 2009–10 at the College of Dentistry, King Saud University, Saudi Arabia, were eligible to participate ($N = 556$). The average age of the study population was 22 years (18–25 years). After having been exposed to the rules of ethics, the participants were briefed on the objective of the study and encouraged to actively participate. In view of existing segregated campuses for men and woman students, including separate classes and clinics, the data sets were acquired separately. A detailed review of the multipronged aspect of the research was elaborated for acceptance and approval by the Ethics Committee of the College of Dentistry Research Centre.

2.2. Study instrument

The study instrument was formulated so as to be cogent and brief to enhance positive feedback with minimal exhaustion (stress) of the participants. We also ensured that the study instrument addressed all areas of interest reliably. A multidimensional study questionnaire, to evaluate dental environmental stressors and to perceive stress and ways of coping was assembled and distributed to the students in the form of hard copy for completion. Thus, the research study instrument consisted of four measures: a demographic list, the DES questionnaire, the BC and the PSS questionnaire. Also, the questionnaire was translated into the vernacular language (Arabic).

2.2.1. DES questionnaire

The research design was modified to accommodate both the clinical and didactic aspects of dental training in Saudi Arabia. This was accomplished using a modified DES questionnaire containing 41 stress-related items. From the original DES questionnaire (Garbee et al., 1980), 25 items were sourced, while the remaining 16 items were included after a review of modified versions of DES published in the literature (Goldstein, 1979; Grandy et al., 1984a, 1989b; Westerman et al., 1993). The 41 items were clustered into seven domains of potential stressors: self-efficacy beliefs (items 1–9), faculty and administration (items 10–19), workload (items 20–25), patient treatment (items 26 to 29), clinical training (items 30–33), performance pressure (items 34–36) and social stressors (items 37–41). It should be noted, however, that the above-mentioned categories were not shown in the questionnaire. The reliability and validity (content, construct and face) of the modified questionnaire was assessed. Validity of the clustered domains was evaluated quantitatively by factor analysis (Al-Sowaygh et al., 2013). Responses from the seven domains were used as dependent variables in the study. Respondents to the DES questionnaire evaluated the items based on their personal experience on a four-point Likert scale that included “not stressful at all,” “somewhat stressful,” “quite stressful” and “very stressful.” For nonapplicable items, a fifth response was included.

2.2.2. PSS questionnaire

A 10-item perceived stress scale, previously validated and utilized by several successful investigators researching student's

stress levels, was employed with an illustrated internal consistency of 0.828 (Cronbach alpha coefficient) (Cohen et al., 1983). With target-specific focus, the Arabic version, which was tested among a sample of US-Arab immigrants (Chaaya et al., 2010) was included in the questionnaire for assessment (the PSS measures the degree to which situations in one's life are appraised as stressful) (Cohen et al., 1983). The original 14-item scale was designed "to recognize the dimension of severity that the respondents found their lives to be unpredictable, uncontrollable, and overloading" (Heath et al., 1999). However, the questions in the PSS scale that assessed the respondent's experience during the past month about the related issue enumerated how often they endured the feeling (Hendricks et al., 1994). The respondent was not trying to count the number of times he or she felt a particular way, but rather indicated the alternative that seems like a reasonable estimate: 0 = Never, 1 = Almost never, 2 = Sometimes, 3 = Fairly often and 4 = Very often. The PSS scores were computed by reversing responses (i.e., 0 = 4, 1 = 3, 2 = 2, 3 = 1 and 4 = 0) to the four positively stated items of 4, 5, 7 and 8. The reverse-coded items were finally summated to the remaining scale items to achieve the assessment score.

2.2.3. Brief COPE questionnaire

The coping strategies that were felt most appropriate to combat the potential stressors under evaluation were assessed using a 28-item BC, the Brief COPE, popularly utilized as a behavioral self-regulation model (Folkman and Lazarus, 1980). However, this scale seeks to evaluate the individual's efforts to encounter, refrain from facing or gain control over the stressful situation. The responses anticipated from participants were based on their kind of reaction to different stressful circumstances in the dental learning environment tabulated on a four-point Likert-type scale. Response choices ranged from "1. I have not been doing this at all" to 4: "I've been doing this a lot." The students made their choices according to the coping tactic most frequently used to manage the stressful events experienced by them in dental school. The selection of measures on the scale was conceived by focusing on the student population under study according to Carver, who advocated that "researchers can select coping scales of particular interest and that does not compromise the validity of this measure" (Carver, 1997b).

2.3. Statistical analysis

The collected data were organized as descriptive, and they included the student's age, gender and year of study; the data were analyzed and tabulated as percentage distribution. The mean score and SD were tabulated for each of the measures

under research. Year in school, gender and marital status were among the independent variables measured. Statistical analysis was done after converting the completed questionnaire to a four-point Likert scale. The analysis was organized by assigning values from 0 to 4 for each response on the Likert scale.

The data were analyzed using the Statistical Package for the Social Sciences statistical software (SPSS Inc, Chicago, IL, USA). Internal consistency of all three tools of the questionnaire was assessed by calculating Cronbach's alpha (Table 1). The Kruskal–Wallis test was employed to determine significant differences between class levels. Differences between individual years were assessed using a pairwise comparison test. The mean DES scores were compared across all the classes. Variation in mean response scores between individual student populations was tested using the *t* test and Levene's test for equality of variances. Dependent variables in the clustered domains of the DES questionnaire were subjected to post hoc analysis to determine whether there was significant effect linked to the independent variables. Univariate ANOVA was done to determine variability between dependent variable groups: year in school, gender and marital status.

3. Results

3.1. Demographic characteristics of the respondents

A total of 425 students of the 556 registered as undergraduate students in the College of Dentistry, King Saud University, were enrolled in the study. Survey questionnaires distributed among the students were internally consistent for all three tools of the questionnaire as assessed by Cronbach's alpha (Table 1). The demographic characteristics of study subjects are presented in (Table 2). Mean age of the respondents was 22 years (range, 18–25 years); 95.7% of the respondents were single and 4.3% were married. Overall the response rate was 76.4%. Among them, 68.9% were male and 31.1% were female. Response rates by year of study were 70.8% for the first-year students, 64% for the second, 83.8% for the third, 89% for the fourth and 77% for the fifth.

3.1.1. Determinants of stress

A detailed determination of the different stress-associated variables under the main seven stressor domains was reported earlier (Al-Sowygh et al., 2013). As evident in Table 3, female students perceived more stress than did males, as there is a significant difference ($p < 0.05$) in the mean scores of males and females for the factors self-efficacy beliefs, faculty administration, workload, patient treatment, clinical training and performance pressure. The mean value of total DES score of the female students was also significantly higher than that of the

Table 1 Measures used in this study and their internal reliability.

No of items	Description and response scales	Cronbach α coefficient
41 Stress-related items	DES modified version: 4-point Likert scale, ("not stressful" to "severely stressful")	0.87–0.89
10-Item perceived stress scale	Cohen's perceived stress scale: 5 point Likert scale ("never" to "very often")	0.80–0.83
28-Items for stress coping	Brief COPE: 4-point Likert-type scale ("I have not been doing this at all" to "I've been doing this a lot")	0.78–0.80

male students ($p < 0.05$). However, there was no statistically significant difference in the mean scores for the factor, social stressors, between male and female students ($p > 0.05$) (Table 3).

Levels of stress for the five study years show a statistically significant difference ($p < 0.05$) in the mean scores for five factors: faculty and administration, workload, patient training, clinical training and performance pressure. Among the 5 years, the mean scores for six of the factors and total score were significantly higher for the third-, fourth- and fifth-year students compared with first- and second-year students, whereas the

mean scores of two factors of the DES instrument (self-efficacy and social stressors) were not significantly different across the 5 years of study subjects ($p > 0.05$). ANOVA showed that there were significant differences between the 5 years of study ($p < .0001$) (Table 4).

Independent t tests showed significant positive associations, as married students reported more stress than single (means = 10.1 for married vs. 9.1 for single, $t = -1.42$, $p = .17$) in relation to patient treatment, performance pressure and social stressors. In contrast, single students reported being more stressed than married students in understanding faculty and administration (means = 25.9 for single vs. 24.3 for married students, $t = 1.18$, $p = 0.25$) (Table 5).

Table 2 Demographic description of the study population.

Variables (N)	n (%)
Total participants (556)	425 (76.4)
Gender	
Male (348)	293 (68.9)
Female (208)	132 (31.1)
Year of study	
Year 1 (113)	80 (18.8)
Year 2 (118)	75 (17.6)
Year 3 (105)	88 (20.7)
Year 4 (108)	96 (22.6)
Year 5 (112)	86 (20.2)
Age (years)	
Mean (SD)	21.52 (1.54)
Median	22
Range	18–25
Marital status	
Single	407 (95.7)
Married	18 (4.3)

3.1.2. Perception of stress

The mean PSS score for the study population was 22.82 (± 3.99), with a range of 8–33. The median score was 23, with cutoff limits for the 25th, 50th and 75th percentiles being 20, 23 and 26, respectively. Among the years of study, fourth year students had the highest scores for PSS, followed by first-year students. Second-year students had the lowest score. Only gender showed significant association with the PSS score ($p < 0.05$) by univariate analysis. Female students perceived stress significantly more than did males (Table 6).

3.1.3. Effectiveness of coping strategies

Among coping strategies, “active coping, planning, religion, and acceptance” were found to be the axioms used by most

Table 3 Comparison of mean scores of factors of dental environment stress between male and female dental students.

Factors	Male mean (SD)	Female mean (SD)	t -Value	p -Value
Self-efficacy*	19.8(5.5)	21.1(6.4)	-2.1	0.04
Faculty and administration*	25.1(6.9)	27.2(6.5)	-2.9	0.003
Workload*	19.7(3.5)	21.4(2.8)	-5.1	<0.0001
Patient training*	8.2(4.9)	9.8(5.1)	-2.9	0.004
Clinical training*	8.9(3.7)	9.6(3.6)	-1.98	0.048
Performance Pressure*	8.3 (2.5)	9.0(2.4)	-2.9	0.004
Social stressors	7.1(4.6)	6.6(5.0)	1.04	0.3
Total SCORE*	97.2(20.7)	104.8(22.2)	-3.33	0.001

* Male mean scores are significantly lower than female mean scores.

Table 4 Comparison of mean scores of factors of dental environment stress among the five year of study.

Factors	Year of study					F -value	p -Value
	1st Mean (SD)	2nd Mean (SD)	3rd Mean (SD)	4th Mean (SD)	5th Mean (SD)		
Self-efficacy	19.1(6.1)	20.4(5.5)	19.3(5.9)	20.9(5.8)	20.6(5.5)	1.15	0.33
Faculty and administration ^a	19.8(6.9)	22.9(5.7)	27.2(6.4)	28.4(5.6)	29.4(4.4)	39.4	<0.0001
Workload ^b	19.1(3.8)	20.6(3.3)	20.4(3.8)	21.4(2.7)	19.6(2.9)	6.2	<0.0001
Patient training ^c	4.6(5.3)	4.0(5.2)	10.9(2.7)	11.8(2.4)	11.0(2.4)	84.8	<0.0001
Clinical training ^d	5.7(4.3)	7.5(4.0)	10.8(2.7)	10.3(2.2)	10.4(2.2)	41.1	<0.0001
Performance Pressure ^e	6.7 (2.4)	6.6(2.1)	9.6(2.0)	9.7(1.8)	9.6(1.8)	53.82	<0.0001
Social stressors	7.1(5.2)	6.4(4.4)	6.0(4.4)	7.6(5.0)	7.6(4.2)	2.06	0.08
Total score ^f	82.8(23.2)	88.5(19.3)	104.2(18.0)	110.2(17)	108.2(14.7)	37.1	<0.0001

^a 1st and 2nd year mean scores are significantly lower than 3rd, 4th, and 5th year mean scores.

^b 2nd, 3rd, and 4th year mean scores are significantly higher.

^c 3rd, 4th, and 5th year mean scores are significantly higher.

^d 3rd, 4th, and 5th year mean scores are significantly higher.

^e 3rd, 4th, and 5th year mean scores are significantly higher.

^f 3rd, 4th, and 5th year mean scores are significantly higher.

Table 5 Comparison of mean scores of factors of dental environment stress questionnaire between single and married dental students.

Factors	Marital status		<i>t</i> -Value	<i>p</i> -Value
	Single mean (SD)	Married mean (SD)		
Self-efficacy	20.3(5.7)	18.0(6.8)	1.43	0.17
Faculty and administration	25.9(6.9)	24.3(5.3)	1.18	0.25
Workload	20.3(3.3)	19.7(4.0)	0.63	0.53
Patient training*	8.6(5.1)	10.9(3.1)	-2.92	0.008
Clinical training	9.1(3.7)	10.1(2.8)	-1.42	0.17
Performance pressure*	8.5 (2.4)	9.7(2.2)	-2.16	0.04
Social stressors*	6.8(4.6)	10.8(5.2)	-3.24	0.004
Total score	99.4(21.5)	103.4(21.1)	-0.76	0.44

* Married mean scores are significantly higher than single mean scores.

Table 6 Perceived stress scale score evaluated across the five year of study and gender distribution.

Perceived stress scale score								
Variable	<i>N</i> (%)	Mean (SD)	Median	Mode	Range	25th Percentile	50th Percentile	75th Percentile
Overall	425	22.82 (3.99)	23	20	8–33	20	23	26
<i>Study year</i>								
Year 1	80 (18.8)	22.94 (3.35)	23	20	15–29	20	23	25
Year 2	75 (17.6)	22.56 (3.88)	22	23	15–30	20	22	26
Year 3	88 (20.7)	22.35 (4.67)	23	21	8–32	20	23	25
Year 4	96 (22.6)	23.97 (3.86)	24	22	16–33	21	24	27
Year 5	86 (20.2)	22.14 (3.85)	22	21	15–30	19	22	25
<i>Gender</i>								
Male	293 (68.9)	22.02 (3.74)	22	20	8–31	20	22	24
Female	132 (31.1)	24.59 (3.99)	25	27	14–33	22	25	28

students. Notably, stress coping strategies relating to “denial,” “humor” and “venting” were least used among the students (Table 7). Stress coping strategies compared between male and female students revealed significant differences (Table 7). In particular, the coping mechanisms of denial ($p = 0.006$), self-blame ($p = 0.036$) and behavioral disengagement ($p = 0.017$) were significant variants among gender distribution.

3.2. Correlation between DES, BC and PSS

Pearson’s correlation analysis was done between demographic variables, stressors, coping strategies and PSS scores. There was significant positive correlation between “year of study” and stressor category relating to “patient treatment.” Also, there were significant positive correlations relating to stressor categories “faculty and administration,” “workload,” “clinical training” and “performance pressure.” Among coping strategies, there was strong positive correlation between “active coping and planning” and “use of emotional and instrumental support”. It was found that, in a stepwise approach out of 20 factors of both DES and BC instruments, six factors were statistically significantly and independently related to perceived stress scores ($F = 34.638$; $p < 0.0001$).

In the Stata regression, the prediction equation with the coefficients on our independent variables (betas), which are the DES and BC and the constant (alpha) values of PSS, tells us how strongly each independent variable is associated with our dependent variable. Out of the seven factors of the DES

instrument, six factors correlated with the scores of the students’ perceived stress (Table 8). And out of 13 factors of the BC instrument, 7 factors correlated with the scores of perceived stress (Table 9). Because these correlation coefficients are statistically significant, the multiple regression analysis was carried out to assess determinants of stressed cases and the factors DES and BC, which are independently related to perceived stress scores. Out of these six factors, the factors self-efficacy (0.237), and workload (0.237) of DES were positively and independently related to the perceived stress scores (Table 10), and the three factors behavioral disengagement (0.189), denial (0.116) and venting (0.104) of the BC showed a weak positive association with perceived stress scores, whereas the factor “positive reframing” (–0.144) of the BC was negatively and independently related to the perceived stress score (Table 10). Analysis predicts that a t value larger than two in absolute value would have a 5% or smaller probability of occurring; it seems to be contributing to the determinants of stress levels. The r^2 value of 33.9% of this model indicates that the change in about 34% of perceived stress scores is explained by the values self-efficacy, workload, behavioral disengagement, positive reframing and denial (Table 10).

4. Discussion

Admissions to professional courses like dentistry have become highly competitive, requiring increased motivation on the part of applicants. It is natural that new students work hard toward

Table 7 Stress coping strategies (BC) questionnaire scores.

Stress coping strategies (BC) questionnaire scores					
Category	Stress coping strategy	BC score			p-Value
		Overall Mean (SD)	Male Mean (SD)	Female Mean (SD)	
Self-distraction	I've been turning to work or other activities to take my mind off things	2.54 (0.98)	2.51 (0.98)	2.62 (0.97)	0.83
	I've been doing something to think about it less, such as going to movies, watching TV, reading, daydreaming, sleeping, or shopping	2.81 (0.95)	2.76 (0.96)	2.90 (0.91)	0.15
Active coping	I've been concentrating my efforts on doing something about the situation I'm in	2.81 (0.83)	2.79 (0.81)	2.86 (0.85)	0.57
	I've been taking action to try to make the situation better	3.15(0.76)	3.12(0.77)	3.21 (0.73)	0.97
Denial	I've been saying to myself "this isn't real"*	1.44 (0.79)	1.41 (0.72)	1.51 (0.91)	0.006
	I've been refusing to believe that it has happened	1.59 (0.88)	1.63 (0.91)	1.52 (0.81)	0.07
Use of emotional support	I've been getting emotional support from others	2.45 (0.96)	2.46 (0.99)	2.42 (0.91)	0.10
	I've been getting comfort and understanding from someone	2.65 (0.95)	2.64 (0.95)	2.68 (0.97)	0.66
Behavioral disengagement	I've been giving up trying to deal with it*	1.61 (0.74)	1.58 (0.70)	1.63 (0.83)	0.036
	I've been giving up the attempt to cope	1.71 (0.81)	1.67 (0.78)	1.77 (0.85)	0.42
Venting	I've been saying things to let my unpleasant feelings escape	2.21 (1.06)	2.22 (1.07)	2.16 (1.01)	0.27
	I've been expressing my negative feelings	2.23 (0.93)	2.19 (0.90)	2.32 (0.97)	0.12
Use of instrumental support	I've been getting help and advice from other people	2.66 (0.94)	2.61 (0.95)	2.76 (0.92)	0.37
	I've been trying to get advice or help from other people about what to do	2.74 (0.93)	2.75 (0.93)	2.72 (0.94)	0.79
Positive reframing	I've been trying to see it in a different light, to make it seem more positive	2.71 (0.88)	2.70 (0.87)	2.70 (0.92)	0.32
	I've been looking for something good in what is happening	2.68 (0.89)	2.69 (0.87)	2.65 (0.94)	0.10
Self-blame	I've been criticizing myself	2.59 (0.91)	2.58 (0.88)	2.60 (0.97)	0.07
	I've been blaming myself for things that happened**	2.51 (0.99)	2.51 (0.95)	2.50 (1.07)	0.017
Planning	I've been trying to come up with a strategy about what to do	2.92 (0.81)	2.88 (0.80)	3.03 (0.84)	0.88
	I've been thinking hard about what steps to take	3.08 (0.82)	3.07 (0.82)	3.11 (0.81)	0.46
Humor	I've been making jokes about it	2.55 (1.07)	2.53 (1.06)	2.58 (1.10)	0.41
	I've been making fun of the situation	2.16 (1.05)	2.17 (1.02)	2.11 (1.12)	0.07
Acceptance	I've been accepting the reality of the fact that it has happened	2.79 (0.91)	2.79 (0.89)	2.77 (0.95)	0.33
	I've been learning to live with it	2.76 (0.81)	2.76 (0.78)	2.76 (0.84)	0.36
Religion	I've been trying to find comfort in my religion or spiritual beliefs	2.71 (0.91)	2.63 (0.88)	2.83 (0.93)	0.81
	I've been praying or meditating	2.92 (0.89)	2.82 (0.86)	3.13 (0.93)	0.10

* Female mean scores are significantly higher than male mean scores.

** Male mean scores are significantly higher than female mean scores.

excellence, helping them not only during the program, but also giving them a competitive edge for postgraduate programs (Lloyd and Musser, 1985). Evidence published in the past three decades points to high levels of stress endured by dental students (Newton et al., 1994). These findings are in accordance with those of our study, wherein students perceived high levels of stress in all seven measured categories. DES, as its name suggests, was designed primarily to evaluate stress among dental students.

Our core objective was to examine how a cohort of Saudi dental students identified their sources of stress, their ability to perceive it and the coping strategies adopted in their immediate environment while cruising through the dental educational program. Consistent with previous study outcomes is our finding that only an atmosphere conducive to study can prevent the student community from capitulating to persistent stress (Naidu et al., 2002). Keeping with the tradition of max-

imum prudence, we adopted the DES questionnaire, the PSS scale and the BC as absolute evaluating implements. Identifying possible causes of stress enables the faculty and administration to alleviate students' stress through modifying the teaching curriculum and environment (Sanders and Lushington, 1999a).

The highest-ranking stressors were those in the domain of workload, a finding that concurs with other studies (Carver et al., 1989a; Radcliffe and Lester, 2003). Clinical training includes fulfilling a specified number of patient procedures in a variety of disciplines, which adds to overall stress. Wegman (1983) investigated the postures of students and found that, as students assumed unnatural body positions, there was an increase in physical stress that adversely affected work performance. Lectures and examinations, coupled with the learning structure of the institution, require students to work harder and longer. Studies have proven that even medical students experience less stress than do dental students, which might be attributed to the additional psychomotor skills needed in dentistry (Murphy et al., 2009).

Newcomers to dental school in the first year face social challenges in terms of people, place and environment, apart from the workload. In this study, we observed an increase in overall mean scores throughout the years of attendance. This correlates with other studies that employed the DES questionnaire (Yap et al., 1996; Sanders and Lushington, 1999a; Naidu et al., 2002). Dahan and Bedos reported the transition from preclinical to the clinical year as highly stressful, as observed in our study (Dahan and Bedos, 2010). Several other investigators have reported changes in environment, teaching patterns and academic fulfillment criteria as reasons for stress in dental students (Morse and Dravo, 2007; Mikolajczyk et al., 2008).

"Clinical requirements" was the greatest stressor, with the highest mean score for the fourth- and fifth-year students, because this factor constitutes the rationale for promotion. Through the years of study, significant differences in stress scores were seen. "Language barrier" was seen as more stressful among first-year students than in the upper classes. The language barrier issue is one that has been extensively discussed with regard to patient care (Rosli et al., 2005). Dentistry at universities is taught mainly in English, and almost all the available references are in English. Overall, students with a poor command of the English language experience a considerable degree of stress during the learning process. However, similar data on dental students are lacking, especially in a country wherein, although English is the medium of college education, most students study English as a second language, suggesting an area of possible future research.

Third-year students, who are more likely to be required to practice advanced laboratory procedures more than would

Table 8 Correlation between the DES factors scores and PSS Score.

DES factors	PSS score	<i>p</i> -Value
Self-efficacy	0.432	< 0.0001
Faculty administration	0.199	< 0.0001
Workload	0.382	< 0.0001
Patient treatment	0.117	0.016
Clinical training	0.198	< 0.0001
Performance pressure	0.201	< 0.0001
Social stressors	0.084	0.08

Table 9 Correlation between the BC factors scores and PSS score.

BC factors	PSS score	<i>p</i> -Value
Self-distraction	0.225	< 0.0001
Active coping	-0.033	0.49
Denial	0.232	< 0.0001
Use of emotional support	0.047	0.33
Use of instrumental support	0.020	0.68
Behavioral disengagement	0.355	< 0.0001
Venting	0.258	< 0.0001
Positive reframing	-0.187	< 0.0001
Planning	-0.033	0.50
Humor	0.181	< 0.0001
Acceptance	-0.064	0.189
Religion	0.028	0.57
Self-blame	0.258	< 0.0001

Table 10 Regression coefficients of DES and BC factors related to PSS Scores.

Independent variables	β -Coefficient	<i>t</i> -Value	<i>p</i> -Value
Constant	4.156	2.106	0.036
Self-efficacy(DES)	0.237	5.117	< 0.0001
Behavioral disengagement (BC)	0.189	4.121	< 0.0001
Workload (DES)	0.237	5.361	< 0.0001
Positive reframing (BC)	-0.144	-3.463	0.001
Denial (BC)	0.116	2.605	0.010
Venting (BC)	0.104	2.370	0.018

their first- and second-year counterparts, reported “Shortage of allocated laboratory time” significantly more stressful. Toward their final years, students are more anxious about their future prospects. This tendency is clearly seen in our study, where fourth- and fifth-year students found “Fear of not having possibility to pursue a post graduate dental education program” significantly more stressful. Garbee et al. (1980) reported that third-year students, who are less exposed to clinical dentistry, found “Difficulty in learning clinical procedures” more stressful than students in years 4 and 5, which was also seen in this study. Clinical-year students, who are expected to finish a certain number of cases under close clinical supervision, rated “Inadequate number of instructors in relation to students” to be significantly more stressful than did first- and second-year students.

Several studies that have assessed perceived sources of stress among dental students have identified potential stressors: information overload, inability to complete the work, improper feedback from supervising staff and perfectionist attitude of students. A positive association between students’ personalities and their stress levels was also reported (Sanders and Lushington, 2002b). Fourth-year students, who are required to find clinical cases to correspond with their courses, reported “Responsibility of getting suitable patients” to be more stressful than did third-year students (Table 5). Final-year students found “Fear of dealing with patients who do not disclose the existence of a contagious disease” less stressful than did third- and fourth-year students, possibly due to their being more familiar with infection control measures (Sofola and Jeboda, 2006).

Modern society has provided greater representation of women in all disciplines. In this study, 37% (208 of 556) of the students were female. Herein, female students perceived significantly greater stress than males. Similar results have been reported by other researchers (Westerman et al., 1993; Yap et al., 1996; Naidu et al., 2002; Pau and Croucher, 2003; Radcliffe and Lester, 2003). Sanders and Lushington (2002b) attribute the high stress levels in females to their psychological makeup and greater expressivity of thoughts and feelings.

Examination of stress scores by marital status showed that married subjects perceived more stress than did single subjects with regard to patient treatment, performance pressure and social stressors, which correlates with other studies (Kaufman et al., 1982; Muirhead and Locker, 2007; Pani et al., 2011). However, married subjects reporting higher stress scores related to patient treatment and performance pressure were in agreement with one recent report on the Saudi population, but was contrary to previous studies done on different ethnic groups, which did not report any significant stress scores other than social stressors (Kaufman et al., 1982; Musser and Lloyd, 1985; Muirhead and Locker, 2007; Pani et al., 2011).

Several modalities to reduce perceived stress among dental students have been reported. They include student-centered academic policies, nonquantitative evaluation of training, feedback and advisory systems for students and overall improvement of the learning environment (Lazarus, 1993). Also, special attention needs to be given to stress reduction among female students. Coping is always associated with stress as a feature of adaptation. Though coping does not directly reduce stress levels, it moderates the impact of stress, according to Lazarus (1993). It has been proven that coping mechanisms are essential for individuals perceiving stress. In this study, we

found a significant correlation between DES scores, perceived stress and coping mechanisms.

This comprehensive approach to evaluate the stressful undergraduate student experience entering dental school is accomplished with evident positive correlation between independent variables DES and BC and the constant variable PSS. Among the sources of dental environmental stressors identified under the seven factors, a significant six correlated with the perceived stress scale (Table 9). These effects on student life are both short- and long-term because of the persistent stressors. Further, the imperative requirement of the coping mechanism is validated by the significant association of seven of the BC instrument scores with the dependant PSS variables (Table 10). The survival time after a critical event is often modified by the supportive coping processes facilitated by physiological or behavioral mechanisms (Ader et al., 1991). Hence, the statistical data reveal that the students in our study population adopted primarily behavioral disengagement, venting and denial modalities to modify the stress perceived during the training program. The F value of 34.63 (significant at $p < 0.0001$) rules out the probability of chance and affirms a significant association between the stressors, the perceived stress and the essential coping mechanisms.

Our study has a number of strengths, including the use of a large sample of students from all 5 years of the dental curriculum, but did have some limitations. Because it was organized as a cross-sectional study, we were constrained by the fact that the difference between the years of study was either preexisting or developing during the progressive study years. Such a design does not facilitate examining longitudinal fluctuations in perceived stressors over time. Bias cannot be ruled out because information was collected from self-administered questionnaires. Moreover, the current research was limited to one dental school in Riyadh, Saudi Arabia, the results of which may not reflect the general trend in other national or regional institutions. Nevertheless, it is our strong opinion that efforts must be made to identify sources and effects of stress among students of professional courses. It is also imperative that the outcomes be discussed with the students in order that a collaborative effort can be made toward reducing perceived stress and its adverse effects.

5. Conclusion

In summary, dental students displayed relatively high perceived stress scores. Female students perceived more stress than did males. Advanced compared with lower-class students and married compared with single students reported more stress. We found the change in values of self-efficacy, workload, behavioral disengagement, positive reframing and denial to independently affect the perceived stress score. Strategies for stress management must be implemented in dental education by advocating health promotion policies to ensure a future supply of effective dentists. We believe that interactive academic sessions on stress control can further encourage dental students to recognize and gauge their stress levels and improve their performance.

Conflict of interest

The authors have no conflict of interest to declare.

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