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Assessing stress and its causes among postgraduate prosthodontics students

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Introduction: Stress is a widespread but multifactorial phenomenon, and dental students are known to experience particularly high levels of perceived stress. While this problem has been extensively studied in undergraduate dental students, there are little data on perceived stress in postgraduate prosthodontic residents. The objective of this study was to assess common potential stress, together with contributing factors, in postgraduate students attending the Prosthodontics Department at King Abdulaziz University Faculty of Dentistry (KAUFD), Jeddah, Saudi Arabia.

Materials and methods: This was an initial exploratory study of perceived stress and contributing factors in postgraduate students to inform future wide-scale investigations. In this cross-sectional study, an electronic survey was distributed to postgraduate students in the Prosthodontics Department at KAUFD to collect demographic data and perceived levels of stress as assessed by a modified form of the Dental Environment Stress Scale (DES). Statistical analysis was performed using RStudio (R v4.3.0).

Results: Thirty-five postgraduate students participated in this study. Academic overload (62.9%) and fear of failure (51.4%) were most commonly reported as causing severe stress in participants. There were no statistically significant differences in commonly reported severe stress ($\geq 40\%$) according to gender, year of study, or previous experience (all $p > 0.05$). However, examination and grading and fear of failure resulted in a higher level of perceived stress in female than male students, and academic overload and requirements produced more stress in students without previous qualifications. Previous experience duration was associated with completing examination requirements and fear of failure domains (Bonferroni-corrected q -values of 0.045 and 0.003, respectively). Nevertheless, as the study was relatively small and conducted in a single institution using a self-reported questionnaire, the results must be cautiously interpreted.

Conclusion: This exploratory pilot study reveals that postgraduate dental students experienced high levels of stress. Periodic assessment of perceived stress levels and possible causative stressors is recommended in academic settings, with the DES a valid instrument for this purpose. Our data are useful for formulating future recommendations on stress management workshops and awareness campaigns within academic curricula at dental schools. However, the findings of this study must be regarded as preliminary and warrant large-scale confirmation to establish generalizability.

KEYWORDS

stress, dental students, psychology, postgraduate, prosthodontics

Introduction

Dentistry is a stressful, life-long profession. Stress usually arises from an imbalance between personal capabilities and external pressures, and this “product of imbalance” is known to lead to burnout in dentistry students, negatively impacting their mental and physical health (Sikka et al., 2021; Tahir et al., 2021). Dental students are known to experience considerable stress (Elani et al., 2014), which not only impairs health but also productivity. Therefore, a comprehensive knowledge of stressors and how they are perceived is essential to mitigate against workplace-based stress, improve health and wellbeing and, in the clinical context, outcomes for patients (Sikka et al., 2021; Tahir et al., 2021).

Several factors predispose dental students to significant levels of stress (Montero-Marin et al., 2014; Salahuddin, 2023). Dental students may be more vulnerable to stress than students in other health professions due to the technical nature of dental procedures, the small margin for error, and limited time available to carry out and complete planned treatments (Demirci et al., 2021; Rayyan et al., 2022; Sattar et al., 2022). Dental studies also have a clinical component that may involve managing challenging patients, heavy workloads (Hayes et al., 2017), and relatively little downtime. For undergraduate dental students, it is known that clinical expertise significantly affects perceived stress (Jowkar et al., 2020). Stress can develop as a result of having too many assignments or exams, competition with other students, a pressure to excel academically, “failure fear” (Narwal et al., 2021), a lack of good relationships with classmates or teachers, personal or financial issues, or exam phobia. Specific subdisciplines may also have specific stressors; for example, the type of fixed prosthodontics procedure being performed has been reported to significantly affect the perceived stress level, with vital tooth preparation and post-space preparation the highest stress-provoking procedures for undergraduate senior students (Rayyan et al., 2022).

Generally, dental students experience higher levels of psychological stress than medical students (Wali et al., 2021). Specific dental education-related stressors include the possibility of not completing course clinical requirements, examinations and grading, the amount of assigned coursework, time limitations, a need to complete preclinical and clinical training, and dental lab cooperation (Meira et al., 2023). Undergraduate dental course requirements, such as the availability of patients and laboratory-related factors, are also significant stressors (Al Sweleh et al., 2017). Furthermore, the development of stress may be influenced by intrinsic factors; for example, gender may play a role as a stress predictor in dental students, with female students showing increased levels of perceived stress than male dental students (Demirci et al., 2021; Meira et al., 2023; Muniz et al., 2022). Other potential non-educational mediators of stress include marital status, with married postgraduate dental students experiencing higher levels of stress than their non-married counterparts (Ghafoor et al., 2020).

Globally, while academic factors like examinations, grading, and workload are often cited as significant stressors (Tahir et al., 2021; Elani et al., 2014; Hayes et al., 2017; Jowkar et al., 2020; Narwal et al., 2021; Wali et al., 2021; Al-Samadani and Al-Dharrab, 2013; Kumar et al., 2009), there are also geographic differences. In Western countries, finance-related stress (i.e., debt) is a dominant stressor (Hayes et al., 2017; Wali et al., 2021). In a study from the UK, elevated levels of stress were associated with poor coping mechanisms (Narwal

et al., 2021). Dental students in Africa reported stress related to resource and material availability (Wali et al., 2021), while Turkish and Iranian dental students were stressed by academic factors, which were related to the year of study (Demirci et al., 2021; Jowkar et al., 2020). Indian dental students experienced stress due to parental pressure (Alzahem et al., 2011). In the Saudi Arabian context, Rayyan et al. reported significant stress in dental students performing fixed prosthodontic procedures related to vital teeth and post-space preparation (Rayyan et al., 2022), and patient and equipment availability, together with lab support, also influenced the amount of perceived stress in dental students in Saudi Arabia (Al Sweleh et al., 2017). However, while most previous studies have focused on students' stress experience, fewer studies have explored related coping mechanisms and their effectiveness in reducing the negative effects (Sikka et al., 2021; Narwal et al., 2021). Most of the existing literature is single-center and observational and did not measure changes in stress over time nor biomarkers of stress (Alzahem et al., 2011).

Saudi Arabia is a diverse country representing a variety of sociocultural origins (Alzahem et al., 2011). This social and cultural diversity may influence perceived stress caused by different stressors, and, as a result, the causes and consequences of stress in dental students in Saudi Arabia may be different to other countries or between different regions within the country. While there have been many global studies of stress levels and risk factors in undergraduate dental students, including in Saudi Arabia, no study on this topic has yet been conducted in Saudi Arabian postgraduate dental students. Therefore, the first aim of this study was to investigate the level of self-perceived stress and determine possible stressors in postgraduate students attending the Prosthodontic Department at King Abdulaziz University, Jeddah, Saudi Arabia. The second aim of the study was to explore whether perceived stress was influenced by gender, year of study, and presence and duration of previous qualifications. The overall goal of the study is to provide administrators and academic staff with country-specific strategies to address student stress (Al-Samadani and Al-Dharrab, 2013). The study had two null hypotheses: (1) first, that postgraduate prosthodontic students experience no psychological distress; and (2) there is no association between gender, level of study, and previous qualifications and their stress experience. Consequently, the study questions were: (i) what are the burden and main causes of perceived stress in postgraduate students in Saudi Arabia, and (ii) do gender, level of study, and previous experiences affect their stress experience?

Materials and methods

This was a pilot study exploring the common causes of stress in postgraduate students and reflected on their perception and understanding of the stress phenomenon in terms of people's lived experiences. This small-scale, exploratory, cross-sectional study was designed to examine methodologies for future use in larger-scale studies exploiting the increasing number of postgraduate dental students across Saudi Arabia and identify challenges and barriers to participant recruitment when exploring common causes of stress.

The Faculty of Dentistry at King Abdul-Aziz University's Research Ethics Committee authorized the study (no. 069-03-23). We distributed an online survey to 35 postgraduate dental students enrolled in the Master's (M) and Board (B) programs at the

Department of Prosthodontics, King Abdul Aziz University, Jeddah. Participants were at different stages of study: first year (M1, B1), second year (M2, B2), and third year (M3, B3).

Characteristics of the study participants

Between 2022 and 2024, the total number of students in the Faculty of Dentistry at King Abdulaziz University was 130 postgraduate students enrolled a cross various academic programs. Of these, 35 students were identified as eligible for inclusion in the present study, as they were enrolled in prosthodontics program. All of the eligible students were contacted via email to participate in the study [21 (60%) male, 14 (40%) female]. Thirteen students were in their first year (M1 *n* = 10, B1 *n* = 3), 14 in their second year (M2 *n* = 9, B2 *n* = 5), and 8 in their final year of study (M3 *n* = 7, B3 *n* = 1). Fifteen students (42.9%) had previous qualifications or clinical experience prior to enrollment in their current postgraduate program (Table 1). Among these, 46.7% had previously undertaken work experience and 46.7% had attended clinical attachments, while one student had previous academic experience. With respect to duration of previous experience, 40.0% had 1–6 months, 13.3% had 6–12 months, 26.7% had 12–24 months, and 20.0% reported >24 months of experience (Table 1).

TABLE 1 Demographic characteristics of the study participants.

Characteristic	Description, N = 35
Gender	
Male	21 (60.0%)
Female	14 (40.0%)
Year of study	
M1 (first year master student)	10 (28.6%)
M2	9 (25.7%)
M3	7 (20.0%)
B1 (first year board student)	3 (8.6%)
B2	5 (14.3%)
B3	1 (2.9%)
Previous clinical or academic experience (qualification prior to enrolment in the current prosthodontics program (other than bachelor degree)	15 (42.9%)
If yes, please mention the qualification*	
Clinical attachment (speciality training)	7 (46.7%)
Clinical experience	7 (46.7%)
Academic course	1 (6.7%)
Period of experience (months)*	
1–6	6 (40.0%)
6–12	2 (13.3%)
12–24	4 (26.7%)
>24	3 (20.0%)

n (%).
*Data are expressed as a proportion of the 15 participants who reported previous experience.

Study design

Students’ perceived level of stress was assessed using a modified form of the Dental Environment Stress Scale (DES), which, due to the nature of the instrument, also identifies the main causes of dental stress. Independent variables were gender, year of study, and previous qualifications. An online questionnaire was generated by a qualified academic prosthodontist, which was subsequently rigorously revised by two academic experts in prosthodontics. The investigator of the reference study undertook a thorough and detailed evaluation, which guided corrections applied prior to distribution of the questionnaire. The questionnaire was based on a previous cross-sectional descriptive study of undergraduate dental students at King Abdulaziz University in Jeddah conducted in 2012, which also used the modified DES to evaluate the prevalence of stress in undergraduate students and its possible causes (Al-Samadani and Al-Dharrab, 2013). The questionnaire link was emailed to participants at their registered email addresses, with reminder emails planned for later. The main investigator’s contact email was provided for all participants to ease communication.

The study questionnaire included an introduction describing the study and a consent agreement for voluntary participation. Responses were anonymous, and no personal nor identifying data were collected to protect participants’ confidentiality. The first part of the questionnaire collected demographic data (gender, postgraduate study year, and previous experience). The second part was a modified version of the dental environment stress scale (DES), first introduced by Garbee et al. (1980). The original DES was a 25-question instrument that has been widely used in stress-related research in dentistry (Sikka et al., 2021; Elani et al., 2014; Demirci et al., 2021; Hayes et al., 2017; Jowkar et al., 2020; Wali et al., 2021; Ghafoor et al., 2020; Al-Samadani and Al-Dharrab, 2013; Kumar et al., 2009; Alzahem et al., 2011). Here we used a modified version of the DES tailored to prosthodontics with 30 closed-ended questions, with adjustments to capture learning and academia- related factors (Elani et al., 2014), clinic- and patient-related factors (Elani et al., 2014), time pressures (Sikka et al., 2021), travel distance to study (Sikka et al., 2021), and a modified original question for prosthodontic lab support (Sikka et al., 2021). The questions in the original DES regarding roommate relations, alcohol consumption, and drug use were not included in our modified version. Therefore, the final instrument (questions shown in Table 2) included 11 factors related to the learning and academic environment, 9 factors relating to clinical and patient circumstances, 7 personal and social factors, 1 factor related to finance, and 2 factors related to distance, time, and the modified question for prosthetic lab. Responses were scored on a Likert scale of no stress, mild to moderate stress, or severe stress. Questions related to marital status, having children, and long-distance travel to dental college contained an additional answer option of “not applicable” (for unmarried participants, having no children, and having no long travel).

The internal consistency of the 30 stress-related items was evaluated using Cronbach’s alpha, which yielded a value of 0.856, supporting the reliability of the instrument and contributing to the internal validity of the study. Also, each participant was asked about the clarity and understanding of each question used in the survey, and they confirmed the clarity of all questions.

All postgraduate students were included in the survey distribution list. Any incomplete surveys were excluded.

TABLE 2 Distribution of stress among participants.

Characteristic	No stress	Mild to moderate stress	Severe stress	Not applicable
Examination and grading	7 (20.0%)	14 (40.0%)	14 (40.0%)	0 (0.0%)
Academic overload	1 (2.9%)	12 (34.3%)	22 (62.9%)	0 (0.0%)
Fear of failure	3 (8.6%)	14 (40.0%)	18 (51.4%)	0 (0.0%)
Completing examination requirements	3 (8.6%)	15 (42.9%)	17 (48.6%)	0 (0.0%)
Difficulty in obtaining suitable patients	3 (8.6%)	15 (42.9%)	17 (48.6%)	0 (0.0%)
Time limitation to do the assigned work	1 (2.9%)	18 (51.4%)	16 (45.7%)	0 (0.0%)
Late patient arrival or failure to attend the appointment	5 (14.3%)	24 (68.6%)	6 (17.1%)	0 (0.0%)
The responsibilities for comprehensive patient care	5 (14.3%)	17 (48.6%)	13 (37.1%)	0 (0.0%)
Obligation to follow the rules and regulations	15 (42.9%)	16 (45.7%)	4 (11.4%)	0 (0.0%)
Conflict with patients	15 (42.9%)	16 (45.7%)	4 (11.4%)	0 (0.0%)
Fear of getting infectious diseases (HIV and HBV)	9 (25.7%)	17 (48.6%)	9 (25.7%)	0 (0.0%)
Lack of patient cooperation in clinic and home care	4 (11.4%)	24 (68.6%)	7 (20.0%)	0 (0.0%)
Financial difficulties	4 (11.4%)	22 (62.9%)	9 (25.7%)	0 (0.0%)
Difficulties in learning clinical procedures	6 (17.1%)	23 (65.7%)	6 (17.1%)	0 (0.0%)
Requiring a prosthodontics lab support for completing clinical work	6 (17.1%)	18 (51.4%)	11 (31.4%)	0 (0.0%)
Dental material availability	5 (14.3%)	20 (57.1%)	10 (28.6%)	0 (0.0%)
Difficulty in completing class work	3 (8.6%)	17 (48.6%)	15 (42.9%)	0 (0.0%)
Inconsistency in feedback regarding work	7 (20.0%)	16 (45.7%)	12 (34.3%)	0 (0.0%)
Attitude of faculty members toward students	9 (25.7%)	13 (37.1%)	13 (37.1%)	0 (0.0%)
Joining extracurricular activities	23 (65.7%)	10 (28.6%)	2 (5.7%)	0 (0.0%)
Difficulties in understanding lectures	9 (25.7%)	23 (65.7%)	3 (8.6%)	0 (0.0%)
Receiving criticism about work	9 (25.7%)	20 (57.1%)	6 (17.1%)	0 (0.0%)
Home atmosphere	19 (54.3%)	16 (45.7%)	0 (0.0%)	0 (0.0%)
Competition with colleagues regarding class work	16 (45.7%)	14 (40.0%)	5 (14.3%)	0 (0.0%)
The distance and time that you need for travel to your dental college (living far away)	12 (34.3%)	11 (31.4%)	8 (22.9%)	4 (11.4%)
Social contact with other students	22 (62.9%)	13 (37.1%)	0 (0.0%)	0 (0.0%)
Physical health problems	9 (25.7%)	19 (54.3%)	7 (20.0%)	0 (0.0%)
Having children at home	13 (37.1%)	7 (20.0%)	5 (14.3%)	10 (28.6%)
Lack the confidence about being a successful dental resident	5 (14.3%)	15 (42.9%)	15 (42.9%)	0 (0.0%)
Experiencing marital problems	10 (28.6%)	8 (22.9%)	9 (25.7%)	8 (22.9%)

Statistical analysis

Statistical analysis was carried out using RStudio (R v4.3.0). Categorical variables are presented as frequencies and percentages. Differences between gender and year of study for items causing maximum stress ($\geq 40\%$ severe stress) were assessed using Pearson's chi-square test or Fisher's exact test as appropriate. The initial focus was on stress domains in which $\geq 50\%$ of participants reported sever stress. This threshold was later reduced to $\geq 40\%$ to replicate the reference study (Al-Samadani and Al-Dharrab, 2013). The adjustment also served to maintain sufficient variability among stress domains, thereby increasing the precision of inferential analyses and ensuring more robust comparisons across gender and academic year.

Fisher's exact test was applied when any expected cell count was less than 5, ensuring the validity of the results. To address the potential

inflation of type I error due to multiple comparisons, we applied Bonferroni correction. All tests were two-tailed, and a p -value or q -value < 0.05 was considered statistically significant.

Results

Distribution of stress

Academic overload and fear of failure were the most prevalent stressors, with 62.9 and 51.4% of participants reporting severe stress in those domains, respectively (Table 2). Other major stressors where $\geq 40\%$ of participants reported severe stress included completing examination requirements (48.6%), difficulty in finding suitable patients (48.6%), time limitation to complete assigned work (45.7%), difficulty in completing

TABLE 3 Association between gender and items showing $\geq 40\%$ severe stress.

Characteristic	Male N = 21	Female N = 14	p-value	q-value
Examination and grading	8 (38.1%)	6 (42.9%)	0.819	>0.999
Academic overload	13 (61.9%)	9 (64.3%)	0.456	>0.999
Fear of failure	9 (42.9%)	9 (64.3%)	0.526	>0.999
Completing examination requirements	10 (47.6%)	7 (50.0%)	0.521	>0.999
Difficulty in obtaining suitable patients	10 (47.6%)	7 (50.0%)	>0.999	>0.999
Time limitation to do the assigned work	9 (42.9%)	7 (50.0%)	>0.999	>0.999
Difficulty in completing class work	10 (47.6%)	5 (35.7%)	0.192	>0.999
Lack the confidence about being a successful dental resident	10 (47.6%)	5 (35.7%)	0.457	>0.999

Data are presented as *n* (%) for severe stress.

Fisher's exact test.

Bonferroni correction for multiple testing.

class work (42.9%), lack of confidence about being a successful dental resident (42.9%), and examination and grading (40.0%). The eight domains with $\geq 40\%$ of participants reporting severe stress were selected for further assessment according to participant characteristics.

In contrast, the least frequently reported stressor was joining extracurricular activities, with only 5.7% of students reporting severe stress, while 65.7% experienced no stress at all. Similarly, 54.3% of students reported no stress related to their home atmosphere, and 62.9% reported no stress related to social contact with other students (Table 2).

Stress differences by gender

When comparing stress levels by gender for the most reported severe stressors ($\geq 40\%$), there were no statistically significant differences between males and females after Bonferroni correction ($q > 0.999$ for all comparisons). Descriptive trends showed that females reported slightly higher levels of severe stress in fear of failure (64.3% vs. 42.9%) and examination and grading (42.9% vs. 38.1%) domains compared with males. Conversely, males reported relatively higher severe stress-related difficulty in completing class work (47.6% vs. 35.7%), and lack of confidence about being a successful dental resident (47.6% vs. 35.7%). Academic overload produced almost similar levels of severe stress in male and female students (61.9% vs. 64.3%, Table 3).

Stress differences by academic year

There were no statistically significant differences according to different academic levels in terms of severe stress for any of the examined domains (all $q > 0.999$). Third-year Master's students (M3) reported the highest percentage of severe stress in academic overload (85.7%), fear of failure (71.4%), completing examination requirements (71.4%), and time limitation (71.4%) domains; such differences did not reach the statistical significance ($p > 0.05$, Table 4).

Influence of previous qualifications

There were no significant associations between having previous clinical or academic qualifications and stress levels (Table 5)

(all p -values > 0.05 , all q -values > 0.999). However, 70.0% of students without previous experience suffered from severe stress due to academic overload compared to students with previous qualifications (53.3%). When examining the relationship between the duration of previous clinical or academic experience and levels of perceived stress among those with previous experience (Table 6), significant associations were identified for two stress domains: fear of failure ($p < 0.001$; $q = 0.003$), with 100% of participants with 1–6 months of experience reporting severe stress, compared to 50.0% in those with 12–24 months of experience and 0% in the 6–12 and > 24 months groups; and completing examination requirements ($p = 0.006$; $q = 0.045$), where 83.3% of participants with 1–6 months of experience reported severe stress, while none of the participants with longer durations of experience (≥ 6 months) reported severe stress in this domain.

Discussion

This study aimed to determine perceived sources of stress and the need for positive coping mechanisms in postgraduate clinical residents in the Department of Prosthodontics at King Abdul-Aziz University to establish whether specific personal factors might influence how stress sources are perceived. Identifying the most important stressors would allow for targeted implementation of stress management strategies, such as changing the curriculum or providing a more supportive atmosphere through a more proactive approach.

Previous studies have shown that postgraduate clinical residents are more stressed than undergraduate dentistry students (Azimurad, 2019). Our results seem to be consistent with this and reject our null hypothesis, with the results indicating that stress is a problem for all postgraduate dental students, who experienced significant levels of emotional stress throughout the first year (M1, B1), second year (M2, B2), and third year (M3, B3) due to the prevalence of stress. Another study conducted in Jordan demonstrated an increase in stress over time and year of study (Abu-Ghazaleh et al., 2016), while clinical performance pressure provoked the highest stress level in undergraduate students (Lin et al., 2020).

The first significant cause of severe stress among dental students was academic overload (62.9%), followed by fear of failure (51.4%), completing examination requirements, and difficulty in finding

TABLE 4 Association between year of study and items showing $\geq 40\%$ severe stress.

Characteristic	M1 (first year master student) N = 10	M2 N = 9	M3 N = 7	B1 (first year board student) N = 3	B2 N = 5	B3 N = 1	p-value	q-value
Examination and grading	4 (40.0%)	3 (33.3%)	4 (57.1%)	1 (33.3%)	2 (40.0%)	0 (0.0%)	0.319	>0.999
Academic overload	6 (60.0%)	4 (44.4%)	6 (85.7%)	1 (33.3%)	4 (80.0%)	1 (100.0%)	0.321	>0.999
Fear of failure	5 (50.0%)	3 (33.3%)	5 (71.4%)	1 (33.3%)	3 (60.0%)	1 (100.0%)	0.833	>0.999
Completing examination requirements	4 (40.0%)	5 (55.6%)	5 (71.4%)	1 (33.3%)	1 (20.0%)	1 (100.0%)	0.300	>0.999
Difficulty in obtaining suitable patients	4 (40.0%)	6 (66.7%)	2 (28.6%)	0 (0.0%)	4 (80.0%)	1 (100.0%)	0.354	>0.999
Time limitation to do the assigned work	4 (40.0%)	3 (33.3%)	5 (71.4%)	1 (33.3%)	2 (40.0%)	1 (100.0%)	0.764	>0.999
Difficulty in completing class work	5 (50.0%)	4 (44.4%)	3 (42.9%)	1 (33.3%)	2 (40.0%)	0 (0.0%)	0.775	>0.999
Lack the confidence about being a successful dental resident	5 (50.0%)	3 (33.3%)	3 (42.9%)	1 (33.3%)	2 (40.0%)	1 (100.0%)	0.990	>0.999

Data are presented as n (%) for severe stress.

Fisher's exact test.

Bonferroni correction for multiple testing.

TABLE 5 Association between having previous clinical or academic experience (qualification) before enrolment in the current prosthodontics program and items showing $\geq 40\%$ severe stress.

Characteristic	Having previous qualification		p-value	q-value
	No N = 20	Yes N = 15		
Examination and grading	7 (35.0%)	7 (46.7%)	0.755	>0.999
Academic overload	14 (70.0%)	8 (53.3%)	0.282	>0.999
Fear of failure	10 (50.0%)	8 (53.3%)	0.600	>0.999
Completing examination requirements	12 (60.0%)	5 (33.3%)	0.209	>0.999
Difficulty in obtaining suitable patients	11 (55.0%)	6 (40.0%)	0.682	>0.999
Time limitation to do the assigned work	10 (50.0%)	6 (40.0%)	0.488	>0.999
Difficulty in completing class work	9 (45.0%)	6 (40.0%)	0.155	>0.999
Lack the confidence about being a successful dental resident	9 (45.0%)	6 (40.0%)	>0.999	>0.999

Data are presented as n (%) for severe stress.

Fisher's exact test.

Bonferroni correction for multiple testing.

suitable patients (48.6% each). These results are consistent with previous studies reporting that academic circumstances contribute to stressful experiences in dental students (Tahir et al., 2021; Elani et al., 2014; Hayes et al., 2017; Jowkar et al., 2020; Narwal et al., 2021; Wali et al., 2021; Al-Samadani and Al-Dharrab, 2013). Our pilot study indicates that postgraduate students are subjected to considerable psychological stress. Prosthodontics residents at King Abdulaziz University must finish several courses during their years of study and pass exams. The curriculum involves general dentistry and specialty courses, each of which has its own requirements and assignments. Frequent presentations, lab work, exams, and assignments are all assessed. Also, the program requires students to complete a certain number of cases of variable complexity to be eligible to sit the final exams. While this intensive course may contribute to elevated stress levels, this must be balanced against maintaining high clinical standards and the development of appropriate competencies.

Senior postgraduate clinical residents often experience high stress, and research demonstrating that coursework difficulty increases over time (Azimurad, 2019). A study conducted in the UK reported

increased stress levels as the academic course proceeded (Collin et al., 2020). The most significant stressor, according to year three postgraduate clinical residents, was academic overload (85.7%), followed by fear of failure (71.4%) and completing examination requirements (71.4%), with the curricular components contributing most to their increased stress levels. Too much work to be done in insufficient time (71.4%), stressful academic activities, and staff criticism of academic and clinical performance are all known to contribute to elevated stress in students due to a greater sense of fear of failure (71.4%). Other contributory factors to final year stress may have included only limited time available to complete clinical requirements, which often requires high standards of lab performance to decrease the risk of needing to remake the prosthesis, thereby delaying case completion. Also, our students must complete department presentations on the final treatment results, which demands a successful treatment outcome and evidence-based treatment approach that can lead to an escalating sense of responsibility and anxiety. Indeed, Azimurad (2019) reported that prosthodontics courses caused students the most stress, with

TABLE 6 Association between period of experience (in months) and items showing $\geq 40\%$ severe stress.

Characteristic	Period of experience				<i>p</i> -value	<i>q</i> -value
	1–6 <i>N</i> = 6	6–12 <i>N</i> = 2	12–24 <i>N</i> = 4	>24 <i>N</i> = 3		
Examination and grading	4 (66.7%)	1 (50.0%)	2 (50.0%)	0 (0.0%)	0.529	>0.999
Academic overload	5 (83.3%)	1 (50.0%)	2 (50.0%)	0 (0.0%)	0.150	>0.999
Fear of failure	6 (100.0%)	0 (0.0%)	2 (50.0%)	0 (0.0%)	<0.001	0.003
Completing examination requirements	5 (83.3%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0.006	0.045
Difficulty in obtaining suitable patients	4 (66.7%)	0 (0.0%)	1 (25.0%)	1 (33.3%)	0.531	>0.999
Time limitation to do the assigned work	4 (66.7%)	0 (0.0%)	2 (50.0%)	0 (0.0%)	0.162	>0.999
Difficulty in completing class work	2 (33.3%)	0 (0.0%)	4 (100.0%)	0 (0.0%)	0.106	0.850
Lack the confidence about being a successful dental resident	3 (50.0%)	1 (50.0%)	2 (50.0%)	0 (0.0%)	0.098	0.780

Data are presented as *n* (%) for severe stress.
Fisher's exact test.
Bonferroni correction for multiple testing.

periodontology the least stressful course, again due to curriculum-related concerns like excessive workloads, inadequate time, and the pressure of academic activities (Azmimurad, 2019).

Postgraduate dental training involves many continuous tests and exams that might increase stress levels (Sikka et al., 2021; Tahir et al., 2021; Salahuddin, 2023; Meira et al., 2023). The limited time available to complete the required work, taking exams, and preparing for the final semester exam could all contribute to academic overload. We similarly found that students are anxious about exams and grades (40.0%) and their ability to meet exam criteria (48.6%). Students reported having to do too many tasks quickly, which left them with no time for social activities. Exam and grade pressure and failure-related anxiety both reflect academic overload, which is not easy to resolve quickly, and are consistent with known stressors such as performance anxiety and failure dread (Al-Samadani and Al-Dharrab, 2013; Kumar et al., 2009).

We did not detect any gender-based differences in our leading stressors, including academic overload and fear of failure. The existing literature on stress and gender imbalance varies. Some researchers have similarly reported no gender differences in regard to perceived dental stress (Muirhead and Locker, 2008; Sofola and Jeboda, 2006), but Kumar et al. (2009) reported that male students experienced higher levels of stress than females. Other studies have also reported a female predominance of stress, perhaps related to cyclic hormonal fluctuations (Sikka et al., 2021; Demirci et al., 2021; Jowkar et al., 2020; Muniz et al., 2022). In Saudi Arabia, there has recently been some equity in employment in men and women, so both genders are now generally subjected to the same work environment stressors, which may explain the similarities seen here. Overall, and within the limitations of the study, the data support the null hypothesis that there is no association between perceived stress and gender.

Allocating suitable patients for treatment in postgraduate clinics (48.6%) created a significant issue with respect to being able to complete clinical work and requirements on time, similar to earlier studies (Wali et al., 2021; Al Sweleh et al., 2017). A lack of available patients is problematic for students, who have limited time to complete their requirements for final exam entry, which may contribute to significant stress. Clinical students must find suitable patients to complete their clinical requirements, a serious issue that may be resolved with proper patient screening and departmental

referrals (Wali et al., 2021). Our unit attempts to proactively solve this issue: prosthodontic screening clinics are scheduled frequently for proper patient selection and introduction to prosthodontic treatment to enhance compliance and cooperation. Also, any history of appointment cancelations is electronically recorded and monitored to evaluate cooperation. However, despite these institutional actions, patient availability remains a problem for dental students, and other interventions, such as public dental health awareness campaigns and patient recruitment programs, are required.

Our results confirm that dentistry is a physically and mentally demanding profession with stringent work schedules that place dentists with the responsibility to maintain their health for patient wellbeing. Improving housing and infrastructure, access to dental materials, and help from the prosthodontics lab to complete restorations have been proposed as a stress-reducing solutions (Cocchiara et al., 2019). Other solutions include limiting the number of patient and school interactions, ensuring availability of qualified student counselors, and providing targeted programs for dentistry students to manage their stress and self-care (Sharma, 2013). Dental students could practice relaxation techniques like yoga and meditation to better manage stress (Gosavi et al., 2012; Peleias et al., 2017), and courses in oratory, psychology, and financial business management could help reduce stress through education and knowledge. Young dentists might benefit from the knowledge and experience gained from specialized courses in patient communication, developing self-confidence, and handling difficult circumstances (Alzahem et al., 2014). Regularly holding such workshops could help reduce stress in dental professionals and improve clinical competency (Antanaviciene et al., 2020). Our new data support our previous findings in undergraduates, where stress could be related to the same circumstances within the same academic environment (Al-Samadani and Al-Dharrab, 2013). While we did not detect an association between year of study and stress, in contrast to undergraduate students, our results should be interpreted with caution for the relatively small sample size due to single-center design where the available number of postgraduate prosthodontic students was limited and this may be due to the newly established program.

With respect to education-related stress factors, adequate preclinical training has been reported as the main factor in

reducing psychosocial stress in dental students (Alzahem et al., 2014). Academic institutions should provide adequate planning, implementation, and enforcement of preclinical training to improve clinical skills and increase student confidence (Rayyan et al., 2022; Haralur and Al-Malki, 2014). This should be accompanied with proper academic support and service visibility, especially during transitional phases of study (start of dental clinics) (Alzahem et al., 2011; Haralur and Al-Malki, 2014). It would be helpful to implement a curriculum revision and development committee within dental schools to update curricula and establish a positive academic environment (Divaris et al., 2008). Moreover, dental colleges should provide adequate lab support for clinical students by employing well-trained technicians, together with regular professional development courses for dental technicians, such as in the application of CAD/CAM and printing technologies, to improve accuracy and reduce student burden. Providing a relaxed environment for feedback meetings and incorporation of extracurricular activities within a timetable might be helpful, supported by courses in time management and life skills, stress management, and coping skills, especially for junior students and students transitioning to clinical work. Incorporation of mental assessments into selection and enrollment processes, together with periodic assessments of stress and stressors and positive coping strategies, are essential (Alzahem et al., 2011). Furthermore, support groups and mentor guidance are essential components of a holistic approach to tackling student stress.

The creation of a positive but safe academic environment must be accompanied by cultivation of ethical and cultural values that boost personal and professional growth (Divaris et al., 2008). Strategies could include provision of on-campus recreational activities and facilities and a clear strategy for assessment and early detection of stress symptoms, together with robust management plans (Alzahem et al., 2011). Flow chart guidelines could represent an innovative approach to help staff identify symptoms of stress such as avoidance, fatigue, weight loss, sleeplessness, and irritability (Rayyan et al., 2022; Sattar et al., 2022; Alzahem et al., 2011; Divaris et al., 2008). Staff training could include workshops that improve awareness about stress and short training courses on relaxation and stress management to help both staff and students (Sattar et al., 2022; Alzahem et al., 2011; Steiner-Hofbauer and Holzinger, 2020). Furthermore, recognition and comprehension of personal and other emotions and regulation of feeling, actions, and behavior toward challenging circumstances is termed emotional intelligence (EI) (Jahan et al., 2022; Mayer et al., 2016; Por et al., 2011). Students with EI show better regulation of emotions and self-control that translates into better stress coping mechanisms, patient communication, and consequently improved patient compliance and satisfaction (Jahan et al., 2022). Therefore, staff and students may benefit from EI training courses by development and enhancement of this skill. Other possibilities for overcoming stress within the institution include cultivation of resiliency, which is the ability to adapt and to recover from emotional and psychological distress (El-Ashry et al., 2023; Ghoneam et al., 2025). To prevent burnout and preserve empathy, measures could be taken to assess for compassion fatigue (El-Ashry et al., 2023). However, such initiatives will need to be adequately resourced, placing strains on institutional budgets, as each requires appropriate training, counseling service support when help is needed, and fit-for purpose environments,

including practical measures like flexible clinical booking and scheduling when needed with easy accessibility for mental health resources and counseling.

Stress experienced at dental school may contribute to future professional life burnout (Muirhead and Locker, 2007). We found that the main stressors were academic factors, which may help to guide future recommendations for institutional action plans. However, other unmeasured factors may influence the stress perceived by dentists. For example, students living with parents may benefit from family financial and psychological support, although one study reported higher stress in these students (Muirhead and Locker, 2007), so further clarification of the association is required. The availability of on-campus entertainment and sport facilities may influence perceived levels of stress (Alzahem et al., 2011). Furthermore, personal factors such as pre-existing mental health problems, financial constraints, family issues, personal beliefs and traits, language barriers, time management issues, and low EI could contribute to an increased level of stress in dental students (Alzahem et al., 2011). As dental programs are one of the most expensive courses, placing additional burden and stress on self-funded dental students (Muirhead and Locker, 2007), government support for these programs should be considered to lower personal debt burdens, reduce the need for part-time work, and restore work-life balance (Alzahem et al., 2011; Divaris et al., 2008).

Limitations of the study

This study has some limitations. This was a single-center study conducted in Saudi Arabia, limiting generalizability. Nevertheless, the results are informative for both local practice and the design of future large-scale studies. The sample size for this pilot study was relatively small, limiting the power and interpretability of the results. Although all prosthodontic postgraduate students participated in the study, the limited number of places negatively affected the number of students available for sampling. There was also a gender imbalance, with an excess of male participants over female participants, so there may be bias, and the findings may not be an accurate reflection of female stress experiences. The response rate was very high, perhaps due to the small-scale, single-center design and because the prosthodontics postgraduate program is relatively new, promoting interest and participation in studies that might lead to improvements. Finally, the study methodology relied on a subjective assessment of stress experience (questionnaire), which is subjected to recall bias. An interview-based study might provide more focused and detailed results. Together, these limitations mean that the results must be interpreted with caution.

Conclusion

Here we investigated the level of self-perceived stress and possible stressors in postgraduate students attending a dental school in Saudi Arabia to pave the way for definitive, multi-center studies. Within the limitations of the small-scale exploratory design, postgraduate dental students at King Abdul-Aziz University School of Dentistry may experience significant levels of stress. However, due to the limitations of this study, the findings can be considered as preliminary and must be cautiously interpreted. Although it establishes feasibility, it warrants further larger-scale, multi-center and comparative studies in the Middle

East and beyond for future planning of stress management strategies for dental students and graduates. In addition, it is recommended to plan for periodic stress assessment research and future powering to guide further larger-scale studies. Future studies should include a larger, longitudinal study and mixed-methods approaches that incorporate not only objective assessment tools but focus groups and interviews to provide more details on the underlying psychological processes related to stress to guide specific interventions.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors without undue reservation.

Ethics statement

The studies involving humans were approved by Research Ethics Committee at King Abdulaziz University, Faculty of Dentistry (no. 069-03-23). The study was conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in the study.

Author contributions

AA: Conceptualization, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Supervision, Validation, Visualization, Writing – original draft, Writing – review & editing.

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