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Original Article

Effects of the COVID-19 pandemic on senior dental students in Korea: Examining stress, burnout, and depression

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KEYWORDS

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inventory

Abstract *Background/purpose:* The COVID-19 pandemic has had a profound and enduring impact on various aspects of society, including medical education and the training of dental students. The field of dentistry, given its nature, is particularly susceptible to the challenges posed by a pandemic. Prolonged exposure to the pandemic is believed to have increased stress and burnout among medical and dental students. This study aimed to investigate and analyze the relationship between COVID-19 and stress, burnout, and depression in Korean dental students.

Materials and methods: A cross-sectional survey was conducted among 162 third and fourth-grade students from the School of Dentistry at Seoul National University. The survey comprised four main sections: general information, the Maslach Burnout Inventory (MBI), the Patient Health Questionnaire-9 (PHQ-9), and the Impact of Event Scale-Revised (IES-R).

Results: The results indicated significant differences in age, study time, career satisfaction, and counseling needs between third and fourth-grade students. The fourth-grade students exhibited higher scores in the IES-R survey, PHQ-9 total score, emotional exhaustion, and depersonalization subscale items of the MBI. Furthermore, the group with abnormal responses to COVID-19 demonstrated lower levels of career satisfaction.

Conclusion: Fourth-grade dental students experienced higher levels of depression, vulnerability to the effects of COVID-19, and burnout. These findings highlight the need for addressing the mental health challenges faced by dental students during the COVID-19 pandemic.

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Introduction

The coronavirus (COVID-19) pandemic has caused disruption and uncertainty in how we live, work, and learn on a daily basis.¹ In the aftermath of prolonged COVID-19 infection, healthcare workers experience increasing stress and burnout. Depending on the severity of COVID-19, several policies have changed, compromising how people work and socialize.

Owing to the nature of the job, medical personnel were unable to stay at home during the pandemic and had to treat patients at the forefront, with no adequate means of relieving stress. Despite the long-lasting impact of COVID-19 on all aspects of society, medical education, including dental treatment and education of students in dental training programs, had to continue. In the field of education, students, faculty, and staff had to adapt to changes on online platforms.^{2,3} It is thought that the degree of burnout of current students has increased due to a lack of opportunities to relieve stress, such as conversations with classmates, counseling with seniors, and club activities.

The field of dentistry is vulnerable to such a pandemic situation because, owing to the nature of its profession, patients need to take off their mask and dentists treat the patient's mouth generating aerosols during treatment, increasing the chance of transmission due to the equipment's mechanisms. To protect both patients and staff, dental staff and hospitals must have sufficient protective equipment and follow strict safety measures.⁴ Dental staff should wear four kinds of personal protective gear, such as Korean Filter (KF) 94 masks that have similar protection to N95 masks, gloves, face shields, and long-sleeved gowns. Everyone who enters the hospital must first be checked for fever. Despite thorough efforts, the risk remains high due to asymptomatic infections.⁵ As COVID-19 positive patients without a fever can come into the clinic and the virus can spread without notice, the risk of infection in the dental office increases.

Moreover, third- and fourth-grade dental students in Korea learn clinical skills by treating patients while being supervised. In a previous study,⁶ it was reported that the level of burnout and depression in Korean dental college students was relatively high. There might have been more difficulties, such as the burden of supplying patients on their own and treatment with infection control in prolonged COVID-19 circumstances. Even before COVID-19, medical students' stress was high,^{6–8} and in the aftermath of prolonged COVID-19, exchanges and emotional support to relieve stress disappeared. Thus, it is thought that the stress and burnout index of medical/dental students has increased.⁹ In this study, the relationship between COVID-19 and stress, burnout, and depression were investigated and analyzed. Furthermore, it is believed that the findings

of this study can help protect the mental health of medical personnel in future pandemic situations.

Materials and methods

Participants

A cross-sectional survey for this study was conducted in June 2021, targeting 162 students in the third and fourth grades of the School of Dentistry, Seoul National University. Informed consent was obtained from all participants prior to the survey. The authors declare no conflicts of interest or compensation for participation. The study protocol of the present study was approved by the Institutional Review Board (IRB) of Seoul National University Dental Hospital, Seoul, Korea (CRI19013). The study was conducted in full accordance with the World Medical Association Declaration of Helsinki.

Survey

The survey was divided into four main types: general information, Maslach Burnout Inventory (MBI), Patient Health Questionnaire-9 (PHQ-9), and Impact of Event Scale-Revised (IES-R). General information included gender, age, grade (study year), marital status, funding for studies, academic grades, academic workload (hours per week), leisure time (hours per week), career satisfaction, and the need for counseling.

The Maslach Burnout Inventory-Human Service Survey (MBI-HSS) is mainly used to evaluate burnout among healthcare workers. It comprises 22 survey items assessing emotional exhaustion (EE, nine items), depersonalization (DP, five items), and personal accomplishment (PA, eight items).^{10,11} All responses were rated on a seven-point Likert scale ranging from zero (never) to six (every day). Scores of $EE \geq 27$, $DP \geq 10$, and $PA \leq 33$ are regarded as thresholds for each item that determines burnout.¹² If all three detailed values are satisfied, the student is considered to be suffering from burnout.

The PHQ-9 is primarily used to measure depressive symptoms.¹³ It is a nine-item questionnaire that assesses participants' emotional state over the past two weeks and is answered on a four-point Likert scale like the MBI, ranging from zero (not at all) to three (almost every day). The resulting score is based on the total sum of nine questions (0–27), and is grouped as minimal (0–4), mild (5–9), moderate (10–14), moderately severe (15–19), and severe (20–27).^{13,14}

The IES-R aims to assess the impact of the COVID-19 pandemic on students, a widely used measurement of subjective distress associated with specific stressful events.^{15–18} It is a 22-item questionnaire answered on a five-

Table 1 Characteristics in each academic year.

Characteristic	Total (n = 156)	Third-year (n = 74)	Fourth-year (n = 82)	P-value
Gender, n (%)				0.3672
Male	85 (54.5)	43 (58.1)	42 (51.2)	
Female	63 (40.4)	29 (39.2)	34 (41.5)	
Unavailable	8 (5.1)	2 (2.7)	6 (7.3)	
Age, median [Q1,Q3]	25.0 [24.0,27.0]	24.0 [23.0,25.8]	26.0 [25.0,27.0]	<0.0001 ***
Marriage, n (%)				0.3748
Single	149 (95.5)	72 (97.3)	77 (93.9)	
Married	5 (3.2)	2 (2.7)	3 (3.7)	
Others	2 (1.3)	0 (0.0)	2 (2.4)	
Funding for studies, n (%)				0.8558
Private	117 (75.0)	54 (73.0)	63 (76.8)	
Loan	35 (22.4)	18 (24.3)	17 (20.7)	
Scholarship	4 (2.6)	2 (2.7)	2 (2.4)	
Academic grade, n (%)				0.6001
Low	10 (6.4)	5 (6.8)	5 (6.1)	
Mid-low	38 (24.4)	15 (20.3)	23 (28.0)	
Mid	62 (39.7)	32 (43.2)	30 (36.6)	
Mid-high	31 (19.9)	13 (17.6)	18 (22.0)	
High	15 (9.6)	9 (12.2)	6 (7.3)	
Study time, n (%)				0.0387 *
< 40 h	48 (30.8)	17 (23.0)	31 (37.8)	
40–50 h	43 (27.6)	26 (35.1)	17 (20.7)	
50–60 h	36 (23.1)	20 (27.0)	16 (19.5)	
60–70 h	13 (8.3)	7 (9.5)	6 (7.3)	
≥ 70 h	16 (10.3)	4 (5.4)	12 (14.6)	
Leisure time, n (%)				0.5196
< 1 h	21 (13.5)	11 (14.9)	10 (12.2)	
1–2 h	63 (40.4)	26 (35.1)	37 (45.1)	
2–3 h	42 (26.9)	19 (25.7)	23 (28.0)	
3–4 h	14 (9.0)	8 (10.8)	6 (7.3)	
≥ 4 h	16 (10.3)	10 (13.5)	6 (7.3)	
Satisfaction, n (%)				0.0038 **
Very dissatisfied (1 point)	1 (0.6)	0 (0.0)	1 (1.2)	
Dissatisfied (2 point)	15 (9.6)	2 (2.7)	13 (15.9)	
Neither dissatisfied nor satisfied (3 point)	51 (32.7)	20 (27.0)	31 (37.8)	
Satisfied (4 point)	68 (43.6)	37 (50.0)	31 (37.8)	
Very satisfied (5 point)	21 (13.5)	15 (20.3)	6 (7.3)	
Counseling needs, n (%)				0.0400 *
Strongly not needed (1 point)	15 (9.6)	12 (16.2)	3 (3.7)	
Not needed (2 point)	21 (13.5)	11 (14.9)	10 (12.2)	
Either not needed or needed (3 point)	53 (34.0)	23 (31.1)	30 (36.6)	
Needed (4 point)	57 (36.5)	26 (35.1)	31 (37.8)	
Strongly needed (5 point)	10 (6.4)	2 (2.7)	8 (9.8)	

***P-value <0.001.

**P-value <0.01.

*P-value <0.05.

point Likert scale ranging from zero (not at all) to four (extremely). It evaluates the symptoms of avoidance, intrusion, and hyperarousal. The overall score ranges from 0 to 88 that is divided into four severity levels: a score of 0–23 (normal state) indicates absence of post-traumatic symptoms, 24–32 (mild) indicates clinically detectable post-traumatic symptoms, 33–36 (moderate) indicates possible post-traumatic stress disorder, and 37 or higher (severe) indicates a condition of severe post-traumatic symptoms.^{18,19}

Statistical analyses

Mean values with standard deviations (SD) or medians with interquartile ranges (IQRs) were used to account for continuous data, as appropriate. Categorical variables were expressed as frequency and percentage values. The Kolmogorov-Smirnov test and Shapiro-Wilk's W test were used to determine whether the underlying distribution was normal per group. Differences between the two groups were evaluated by Student's t-test for continuous variables with

Table 2 Psychological scales in each academic year.; Impact of Event Scale – Revised (IES-R) scores, Maslach Burnout Inventory (MBI), and Patient Health Questionnaire-9 (PHQ-9).

Psychological scale	Total (n = 156)	Third-year (n = 74)	Fourth-year (n = 82)	P-value
IES-R^a				
Total score, median [Q1,Q3]	8.0 [2.0,27.2]	5.0 [2.0,17.2]	14.5 [2.0,40.2]	0.0284 *
Categories, n (%)				0.0026 **
Normal	109 (69.9)	60 (81.1)	49 (59.8)	
Mild	14 (9.0)	7 (9.5)	7 (8.5)	
Moderate	1 (0.6)	1 (1.4)	0 (0.0)	
Severe	32 (20.5)	6 (8.1)	26 (31.7)	
Subscale score, median [Q1,Q3]				
Intrusion	1.0 [0.0,9.0]	1.0 [0.0,5.8]	4.0 [0.0,14.0]	0.0154 *
Hyperarousal	2.0 [0.0,6.0]	1.0 [0.0,4.0]	3.0 [0.0,11.0]	0.0093 **
Avoidance	4.0 [0.0,13.0]	3.0 [0.0,8.0]	8.0 [1.0,16.0]	0.0087 **
MBI^b				
Categories, n (%)				0.0863
Non-burnout	111 (71.2)	58 (78.4)	53 (64.6)	
Burnout	45 (28.8)	16 (21.6)	29 (35.4)	
Subscale score				
Emotional Exhaustion, mean ± std	35.4 (10.8)	31.2 (10.6)	39.1 (9.5)	<0.0001 ***
Categories, n (%)				0.0148 *
Low	7 (4.5)	6 (8.1)	1 (1.2)	
Medium	14 (9.0)	10 (13.5)	4 (4.9)	
High	135 (86.5)	58 (78.4)	77 (93.9)	
Depersonalization, median [Q1,Q3]	17.0 [13.0,22.0]	14.0 [10.2,17.8]	20.5 [15.0,24.0]	<0.0001 ***
Categories, n (%)				0.1946
Low	0 (0.0)	0 (0.0)	0 (0.0)	
Medium	15 (9.6)	10 (13.5)	5 (6.1)	
High	141 (90.4)	64 (86.5)	77 (93.9)	
Personal Accomplishment, mean ± std	36.4 (7.0)	36.5 (7.4)	36.3 (6.7)	0.8912
Categories, n (%)				0.9136
Low	71 (45.5)	35 (47.3)	36 (43.9)	
Medium	61 (39.1)	28 (37.8)	33 (40.2)	
High	24 (15.4)	11 (14.9)	13 (15.9)	
PHQ-9^c				
Total score, median [Q1,Q3]	7.0 [3.0,11.0]	4.5 [2.0,8.0]	10.0 [6.0,13.8]	<0.0001 ***
Categories, n (%)				<0.0001 ***
No or minimal depression	50 (32.1)	37 (50.0)	13 (15.9)	
Mild depression	47 (30.1)	22 (29.7)	25 (30.5)	
Moderate depression	39 (25.0)	13 (17.6)	26 (31.7)	
Moderately severe depression	15 (9.6)	1 (1.4)	14 (17.1)	
Severe depression	5 (3.2)	1 (1.4)	4 (4.9)	

***P-value <0.001.

**P-value <0.01.

*P-value <0.05.

^a IES-R; Impact of Event Scale – Revised.^b MBI; Maslach Burnout Inventory.^c PHQ-9; Patient Health Questionnaire-9.

normal distribution and the Mann-Whitney *U* test for continuous variables with non-normal distribution. Categorical (discrete) variables were compared using the chi-squared test. Distribution differences are presented with *P*-values <0.05 for statistical significance with three criteria. Cronbach's alpha (α) was used as a measure of internal consistency among survey types and was presented with a 95% confidence interval (95% CI). All statistical analyses were performed with SciPy 1.2.2 library in Python 3.7.

Results

A total of 162 students, including 77 third graders and 85 fourth graders, responded to the questionnaire. After excluding six students who did not complete the questionnaires, we analyzed the data of 156 students. Between third and fourth grade students, there was a significant difference in age, study time, career satisfaction, and

counseling needs. The demographic information and survey results are shown in Tables 1 and 2, respectively.

As a result of the IES-R survey, fourth graders showed significantly higher values than third graders. A significantly higher number of students with severe IES-R results were observed in fourth grade, and fourth grade students were significantly higher in all specific domains of intrusion, hyperarousal, and avoidance.

In general, the results of the MBI survey showed a similar pattern, with no significant difference between the third and fourth grades. However, in the MBI subscale items, emotional exhaustion and depersonalization showed significantly higher results in the fourth grade, while personal accomplishment was not significant. Figs. 1 and 2 also show the trend of the depersonalization and personal accomplishment scores according to the satisfaction and needs of counseling results over the academic year. In general, fourth grade students had higher depersonalization scores, and their scores also showed negative and positive relationships with satisfaction and counseling need scores, respectively (Fig. 1). Higher personal accomplishment scores were associated with higher career satisfaction (Fig. 2).

Finally, the PHQ-9 total score was significantly higher among fourth grade students than third grade students (Table 2). The relationship between the variables based on the normal and the abnormal (mild, moderate, and severe) group was investigated through IES-R in response to the event 'COVID-19'. Differences in demographic information, marital status, grades, academic and leisure times, satisfaction, and counseling needs were examined for 109 normal and 47 abnormal patients. Regarding career satisfaction, the group with abnormal responses to COVID-19

showed a relatively low level of satisfaction. However, there was no significant difference in the request for counseling, despite the relatively high results. The amount

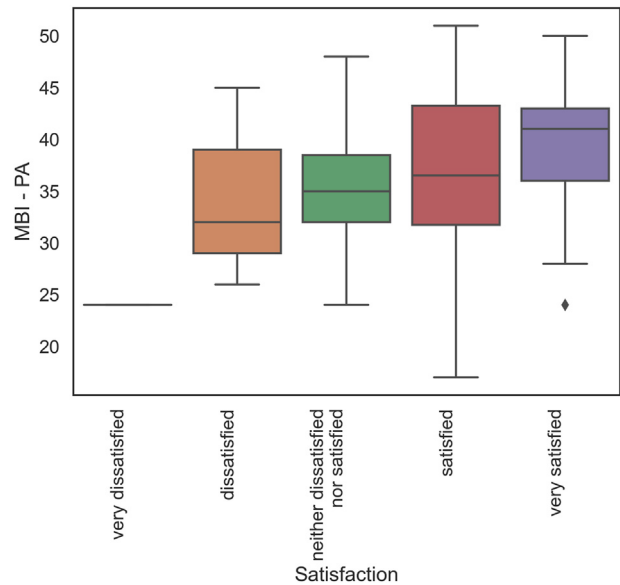


Figure 2 Association between Maslach Burnout Inventory (MBI) – Personal Accomplishment (PA) and Satisfaction.; The box plot illustrates the distribution of MBI-PA scores based on satisfaction. It displays the quartiles of the data, with the box representing the interquartile range (Q1 – Q3) and the whiskers indicating the remaining data distribution, excluding any outliers identified using the interquartile range method. Outliers are represented as rhombic points.

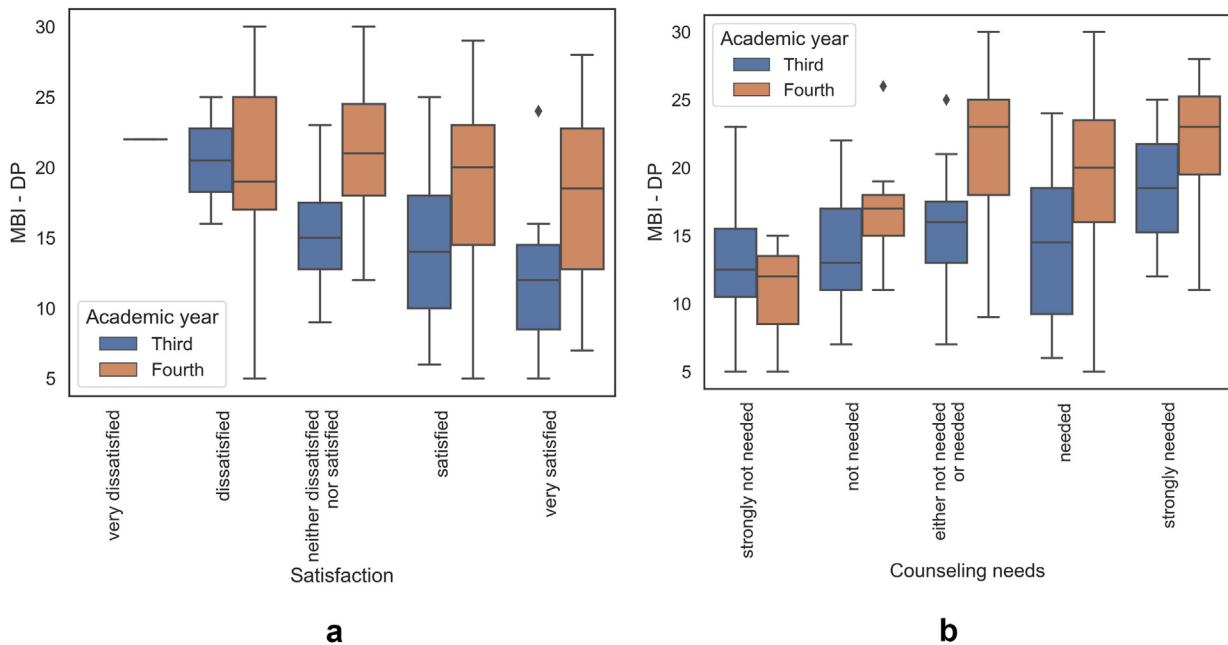


Figure 1 Association between Maslach Burnout Inventory (MBI) – Depersonalization (DP) and Satisfaction (a) and Counseling Needs (b) per Academic Year.; The box plot illustrates the distribution of MBI-DP scores based on satisfaction levels and counseling needs across third- and fourth-year students. It displays the quartiles of the data, with the box representing the interquartile range (Q1 – Q3) and the whiskers indicating the remaining data distribution, excluding any outliers identified using the interquartile range method. Outliers are represented as rhombic points.

Table 3 Characteristics of dental students according to Impact of Event Scale - Revised (IES-R) scores.

Characteristic	Total (n = 156)	Normal (n = 109)	Abnormal ^a (n = 47)	P-value
Gender, n (%)				0.7369
Male	85 (54.5)	58 (53.2)	27 (57.4)	
Female	63 (40.4)	46 (42.2)	17 (36.2)	
Unavailable	8 (5.1)	5 (4.6)	3 (6.4)	
Age, median [Q1,Q3]	25.0 [24.0,27.0]	25.0 [24.0,26.0]	25.0 [24.0,28.0]	0.0806
Academic year, n (%)				0.0064 **
Third-year	74 (47.4)	60 (55.0)	14 (29.8)	
Fourth-year	82 (52.6)	49 (45.0)	33 (70.2)	
Marriage, n (%)				0.5786
Single	149 (95.5)	104 (95.4)	45 (95.7)	
Married	5 (3.2)	3 (2.8)	2 (4.3)	
Others	2 (1.3)	2 (1.8)	0 (0.0)	
Funding for studies, n (%)				0.3652
Private	117 (75.0)	82 (75.2)	35 (74.5)	
Loan	35 (22.4)	23 (21.1)	12 (25.5)	
Scholarship	4 (2.6)	4 (3.7)	0 (0.0)	
Academic grade, n (%)				0.6924
Low	10 (6.4)	6 (5.5)	4 (8.5)	
Mid-low	38 (24.4)	24 (22.0)	14 (29.8)	
Mid	62 (39.7)	44 (40.4)	18 (38.3)	
Mid-high	31 (19.9)	24 (22.0)	7 (14.9)	
High	15 (9.6)	11 (10.1)	4 (8.5)	
Study time, n (%)				0.6427
< 40 h	48 (30.8)	30 (27.5)	18 (38.3)	
40–50 h	43 (27.6)	30 (27.5)	13 (27.7)	
50–60 h	36 (23.1)	28 (25.7)	8 (17.0)	
60–70 h	13 (8.3)	9 (8.3)	4 (8.5)	
≥ 70 h	16 (10.3)	12 (11.0)	4 (8.5)	
Leisure time, n (%)				0.7720
< 1 h	21 (13.5)	16 (14.7)	5 (10.6)	
1–2 h	63 (40.4)	43 (39.4)	20 (42.6)	
2–3 h	42 (26.9)	27 (24.8)	15 (31.9)	
3–4 h	14 (9.0)	11 (10.1)	3 (6.4)	
≥ 4 h	16 (10.3)	12 (11.0)	4 (8.5)	
Satisfaction, n (%)				0.0053 **
Very dissatisfied (1 point)	1 (0.6)	1 (0.9)	0 (0.0)	
Dissatisfied (2 point)	15 (9.6)	10 (9.2)	5 (10.6)	
Neither dissatisfied nor satisfied (3 point)	51 (32.7)	27 (24.8)	24 (51.1)	
Satisfied (4 point)	68 (43.6)	51 (46.8)	17 (36.2)	
Very satisfied (5 point)	21 (13.5)	20 (18.3)	1 (2.1)	
Counseling needs, n (%)				0.0775
Strongly not needed (1 point)	15 (9.6)	15 (13.8)	0 (0.0)	
Not needed (2 point)	21 (13.5)	15 (13.8)	6 (12.8)	
Either not needed or needed (3 point)	53 (34.0)	33 (30.3)	20 (42.6)	
Needed (4 point)	57 (36.5)	40 (36.7)	17 (36.2)	
Strongly needed (5 point)	10 (6.4)	6 (5.5)	4 (8.5)	

**P-value <0.01.

^a Abnormal is defined as students who present mild, moderate, or severe on the IES-R survey.

of time spent for studying and leisure did not show any significant results, as shown in [Table 3](#).

The group considered to be relatively affected by the IES-R results showed higher values in all the subscale scores, such as intrusion, hyperarousal, and avoidance compared to the normal group. Among the MBI sub-items,

emotional exhaustion and depersonalization were significantly correlated with IES-R survey results ([Table 4](#), [Fig. 3](#)). Subscale scores were higher in the abnormal group than in the normal group. Compared with [Fig. 3\(b\)](#), in [Fig. 3\(c\)](#) and (d), emotional exhaustion and depersonalization showed a statistically significant positive

Table 4 Psychological scales according to Impact of Event Scale - Revised (IES-R) scores.; Maslach Burnout Inventory (MBI), Patient Health Questionnaire-9 (PHQ-9).

Psychological scale	Total (n = 156)	Normal (n = 109)	Abnormal ^a (n = 47)	P-value
IES-R^b				
Total score, median [Q1,Q3]	8.0 [2.0,27.2]	4.0 [0.0,9.0]	41.0 [29.5,45.0]	<0.0001 ***
Categories, n (%)				<0.0001 ***
Normal	109 (69.9)	109 (100.0)	0 (0.0)	
Mild	14 (9.0)	0 (0.0)	14 (29.8)	
Moderate	1 (0.6)	0 (0.0)	1 (2.1)	
Severe	32 (20.5)	0 (0.0)	32 (68.1)	
Subscale score, median [Q1,Q3]				
Intrusion	1.0 [0.0,9.0]	0.0 [0.0,3.0]	14.0 [10.5,16.5]	<0.0001 ***
Hyperarousal	2.0 [0.0,6.0]	0.0 [0.0,2.0]	11.0 [7.5,12.0]	<0.0001 ***
Avoidance	4.0 [0.0,13.0]	2.0 [0.0,4.0]	16.0 [14.0,17.0]	<0.0001 ***
MBI^c				
Categories, n (%)				0.3497
Non-burnout	111 (71.2)	80 (73.4)	31 (66.0)	
Burnout	45 (28.8)	29 (26.6)	16 (34.0)	
Subscale score				
Emotional Exhaustion, mean ± std	35.4 (10.8)	33.6 (11.2)	39.4 (8.5)	0.0232 *
Categories, n (%)				0.0019 **
Low	7 (4.5)	7 (6.4)	0 (0.0)	
Medium	14 (9.0)	13 (11.9)	1 (2.1)	
High	135 (86.5)	89 (81.7)	46 (97.9)	
Depersonalization, median (IQR ^e)	17.0 [13.0,22.0]	16.0 [12.0,22.0]	20.0 [15.5,24.0]	0.0043 **
Categories, n (%)				0.9909
Low	0 (0%)	0 (0%)	0 (0%)	
Medium	15 (9.62%)	11 (10.09%)	4 (8.51%)	
High	141 (90.38%)	98 (89.91%)	43 (91.49%)	
Personal Accomplishment, mean ± std	36.4 (7.0)	36.8 (7.3)	35.4 (6.2)	0.2774
Categories, n (%)				0.2550
Low	71 (45.5)	53 (48.6)	18 (38.3)	
Medium	61 (39.1)	38 (34.9)	23 (48.9)	
High	24 (15.4)	18 (16.5)	6 (12.8)	
PHQ-9^d				
Total score, median (IQR ^e)	7.0 [3.0,11.0]	5.0 [2.0,9.0]	11.0 [8.5,15.0]	<0.0001 ***
Categories, n (%)				<0.0001 ***
No or minimal depression	50 (32.1)	44 (40.4)	6 (12.8)	
Mild depression	47 (30.1)	38 (34.9)	9 (19.1)	
Moderate depression	39 (25.0)	21 (19.3)	18 (38.3)	
Moderately severe depression	15 (9.6)	4 (3.7)	11 (23.4)	
Severe depression	5 (3.2)	2 (1.8)	3 (6.4)	

***P-value <0.001.

**P-value <0.01.

*P-value <0.05.

^a Abnormal is defined as students who present mild, moderate, or severe on the IES-R survey.^b IES-R; Impact of Event Scale – Revised.^c MBI; Maslach Burnout Inventory.^d PHQ-9; Patient Health Questionnaire-9.^e IQR; Interquartile Range.

correlation with the IES-R score. However, the total score on the PHQ-9 survey showed an even stronger correlation with the IES-R score, as shown in Fig. 3(a). Table 4 also shows significant results between the IES-R value and PHQ-9. The PHQ-9 total score in the IES-R abnormal group was 11.0 [8.5,15.0] that was significantly higher than the value of 5.0 [2.0,9.0] in the normal group (P-value: <0.0001). In

addition, the majority of participants in the normal group (40.4%) exhibited no or minimal depression, whereas the predominant choice in the abnormal group (38.3%) showed moderate depression. Cronbach's α values followed this pattern. The MBI, PHQ-9, and IES-R had the following α values with 95% CI: 0.82 [0.78–0.86], 0.89 [0.86–0.91], and 0.97 [0.96–0.98].

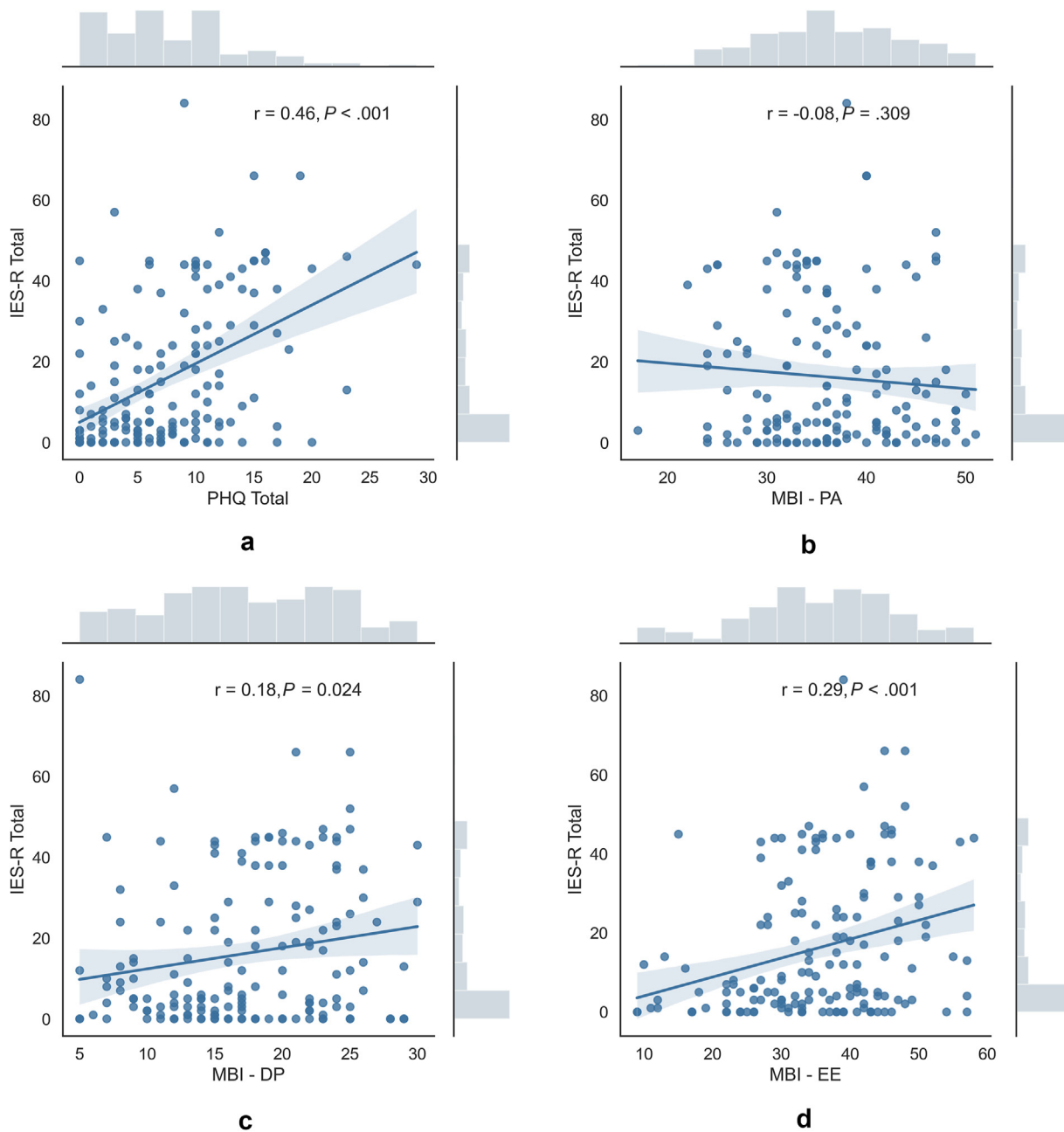


Figure 3 Association between Impact of Event Scale - Revised (IES-R) Score and Maslach Burnout Inventory (MBI) and Patient Health Questionnaire-9 (PHQ-9) Scores.; a) PHQ-9 total, b) Personal Accomplishment (PA), c) Depersonalization (DP), d) Emotional Exhaustion (EE).; Each panel shows the joint distribution of data using a scatter plot with a regression line, along with distribution plots representing the marginal distribution for two variables. The blue points and regression line illustrate the association between the two variables, while the grey bar plots display the individual univariate distributions.

Discussion

Clinical practice begins in the third year of the regular curriculum in the Graduate School of Dentistry. The fourth graders must recruit patients and fulfill clinical practice cases themselves. Clinical practice that includes taking patients' history, determining dental illness, diagnosing, and performing dental treatment, can be psychologically challenging and stressful. Recruiting a large number of

diverse patients according to graduation requirements is not as easy as it might seem, and it is an additional burden on top of treating the patients.

The fourth year of dental school was observed to have significantly lower job satisfaction than the third year due to difficulties in dealing with patients, and the request for counseling was also relatively high in the fourth year. In particular, the IES-R result value that is a response to the COVID-19 event, was observed to be significantly higher in

Table 5 Comparison of the dental students' Patient Health Questionnaire-9 (PHQ-9) score with the author's previous paper.

	PHQ-9 ^a score (n = 123, Kwak et al., 2021) ⁶	PHQ-9 ^a score (n = 156, 2022)	P-value
No or minimal depression	59 (52.7%)	50 (32.1%)	0.0015 **
Mild depression	34 (30.4%)	47 (30.1%)	
Moderate depression	10 (8.9%)	39 (25.0%)	
Moderately severe depression	6 (5.4%)	15 (9.6%)	
Severe depression	3 (2.7%)	5 (3.2%)	

**P-value <0.01.

^a PHQ-9; Patient Health Questionnaire-9.

the fourth grade. This could be because, as described above, the fourth graders may have experienced a lot of pressure due to the course structure. Students need to recruit and perform dental treatment for patients, but the circumstances for fourth grade students in the COVID-19 era have become more difficult due to the high level of caution required for safety reasons from both patients and dental staff. In the field of dentistry, it is undoubtedly a high-risk factor for SARS-CoV-2 transmission because patients have to take off their masks to be treated, therefore, droplet splash and aerosols are generated during the treatment process.^{4,20} Patients are also afraid to visit the hospital and remove their masks for treatment.

Dental clinicians can be in danger of coming into contact with confirmed patients, thus making the dental treatment process inevitably stressful for both. Moreover, the incubation period of SARS-CoV-2 is long, and there can be many asymptomatic positive patients. Therefore, it is difficult to discern sick and healthy patients using simple questionnaires and fever tests that are used to allow patients into clinics.^{5,21} Under the COVID-19 situation, there may have been a considerable amount of difficulty for novice dentists, much like with experienced dentists. At the end of the semester, the students were under psychological pressure to meet the case requirements for graduation. In addition, in the case of Korea, although visits to hospitals were not systematically prevented, it is also true that policies such as group restrictions, unnecessary going out, and social distancing caused psychological atrophy.^{22–24}

There was a significant difference between the third and fourth grades in emotional exhaustion and depersonalization among the MBI subscales, and all of them were higher in the fourth grade. The number of students who showed burnout results through the MBI survey was 17.9% in the author's previous paper⁶; however, it was 28.8% in this study. In the case of PHQ-9, an indicator of the degree of depression, a significantly higher value was also shown in the fourth grade, and the overall distribution was toward severe depression compared with the previous paper (Table 5).⁶ The higher the DP score in the MBI, the lower the satisfaction of the students and the higher the request for counseling. Satisfaction was also low among students with low personal accomplishment. Thus, it can be observed that these two facts are aligned with the results of the author's last paper.

Existing studies on burnout mainly used the MBI and PHQ-9. In contrast, in this study, we investigated the impact of the COVID-19 crisis through a questionnaire called the IES-R. The PHQ-9 showed a slightly higher

correlation with the IES-R than with the MBI (Fig. 3). It is believed that the PHQ-9, which has been used to measure and quantify the emotional element of depression, was affected by the 'corona blue', a symptom of the blues due to COVID-19. The PHQ-9 can be considered more suitable than the MBI for simply investigating the emotional impact of a particular event, with reasonable results and relatively few questions. The relationship between the MBI and IES-R may seem relatively weak, as the subscales investigated in the MBI, particularly personal accomplishment values, are not indicators that are significantly affected by events such as COVID-19. Personal accomplishment is not a measure that is affected or expressed in a short period; it may be diluted by the stress caused by COVID-19. COVID-19 disrupted all areas of daily life, work, and learning, and caused uncertainty.¹ Similarly, this can be explained by the fact that these multifaceted uncertainties caused stress and burnout in dental students as well.

The Cronbach's α values (IES-R 0.97 [0.96–0.98] vs. MBI 0.82 [0.78–0.86] and PHQ-9 0.89 [0.86–0.91]) also follow this pattern. Cronbach's α can be affected by the concept or type of survey itself, as well as by the number of questions. However, the subtotal scores, MBI (3 items: Total EE, Total DP, Total PA) with 0.33 [0.11–0.49], and IES-R (3 items: Total Intrusion, Total Hyperarousal, Total Avoidance) with 0.95 [0.93–0.96], support this claim that, regardless of the number of questions, the IES-R survey was observed with the highest consistency in the psychological crisis related to COVID-19 than other survey methods.

In conclusion, we found that fourth-grade students were relatively depressed, tended to be affected, and burned out in COVID-19 circumstances. Among the several surveys, the IES-R and PHQ-9 had the highest correlation. Moreover, dental students taking a new step in society may have been affected both as students and professionals. Addressing psychological distress caused by inadequate support in the education system and a lack of social support is actionable. It is vital to systematize easily accessible counseling process and uninterrupted pre-clinic procedures while maintaining strict infection control. This study will help to enhance the mental well-being of healthcare workers in light of the emerging epidemic.

Declaration of competing interest

The authors have no conflicts of interest relevant to this article.

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