




The Impact of COVID-19 Fatigue and Pandemic Burnout alongside Academic Stress on the Gingival Health of Dental Students

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Abstract

Objectives Stress has delirious effects on gingival health. Dental students experience higher levels of academic stress during their education that requires clinical and patient management skills. Coronavirus disease 2019 (COVID-19) fatigue is a type of chronic stress that has put the population under high stress for an extended period of time. This study aimed to assess the impact of pandemic burnout and fatigue on the gingival health of academically stressed dental students.

Materials and Methods This study compared junior ($n = 20$) and senior ($n = 20$) year dental students undergoing their final year exams. Gingival health was assessed by plaque index (PI), gingival index (GI), and modified papillary bleeding index (MPBI). Academic stress was measured by the dental environmental stress questionnaire, while COVID-19 burnout was judged by COVID-19 student stress questionnaire (CSSQ).

Statistical Analysis Quantitative data were expressed as mean, standard deviation and median Student's *t*-test was used to compare two categories for normally distributed quantitative variables, while significance of the obtained results was judged at the 5% level.

Results Gingival health evaluation revealed no significant differences in GI and PI; however, MPBI in juniors was more significant ($p < 0.001$). Academic stress was significantly higher among seniors ($p = 0.001$); nevertheless, CSSQ showed low levels of stress toward the pandemic with no significant differences.

Conclusion Gingival diseases are multifactorial in nature; stress is a biologically influencing factor as well. Despite the evidence of high academic stresses among dental students, the impact of COVID-19 fatigue on gingival health was inconclusive and slight differences were found between junior and senior-year dental students.

Keywords

- ▶ academic
- ▶ COVID-19
- ▶ dental students
- ▶ gingiva
- ▶ stress

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Introduction

Human infection by coronavirus started in Wuhan, China, in 2019 leading to an ongoing pandemic. In 2020 the coronavirus disease 2019 (COVID-19) epidemic turned the world upside down, pushing governments to take unprecedented measures such as wearing face masks in public, maintaining physical distance and mandating frequent hand sanitization to prevent the spread of the disease.¹ It is a contagious disease caused by severe acute respiratory syndrome coronavirus 2. This pandemic has led to the increased loss of lives, jobs, and more.² To deal with these problems, the population had to receive two doses of vaccine to return to normal life. In 2021, the new variant of coronavirus, named omicron, surfaced leading to the need for a third immunity dose due to the variant's characteristics of increased infectivity rate.¹

Outbreaks of infectious diseases such as COVID-19 are concerning and affect mental and psychological health that place individuals under tremendous amounts of stress. While it is important to stay informed on new updates regarding the epidemic, it is equally important for individuals to be vigilant about the sources and validity of the news they consume. This is because news sources have proven to be deceptive and/or inaccurate throughout their pursuit of presenting news regarding COVID-19, resulting in more unnecessary stress.³

Another measurement for confining the spread of COVID-19 was mandatory isolation. Isolation resulted in increased levels of anxiety among people. Being required to stay at home and avoid in-person interactions has had a tangible impact on psychological health. Governments guaranteed that life will eventually return to normalcy following the spread of vaccinations and therapies; however, many communities are still suffering from pandemic exhaustion of long-term fatigue and pandemic-related fear and anxiety that can further relate to the development of psychiatric illnesses and chronic fatigue.³

An important group of individuals that have had substantial amounts of stress during this epidemic are students of varying stages. Particularly, dental students those at undergraduate level face various challenges during their studies since it is a stressful learning environment as it requires clinical skills and patient management skills. COVID-19 pandemic has made it more complicated to do so. The struggle with COVID-19 has spanned for almost 2 years, throughout which, many students have contracted the virus resulting in further fatigue and academic burnout and stress.^{4,5}

Fatigue affects senior dental students because treating patients and dealing with them daily is a part of their job. Even though, things have returned to their normal state, the same precautions of wearing masks, hand washing, being wary of the patient's medical history, as well as dealing with patient compliance and health behavior during duress place students under pressure and add on to their preexisting stress towards academic achievement.⁴⁻⁷

In addition, shifting to online teaching has also been a vital change through which many students have expressed it to be a stress increasing factor.^{8,9} Furthermore, dental students

are particularly at higher risk of exposure to 2019-nCoV infection due to face-to-face interactions and regular exposure to bodily fluids such as blood and saliva. In return, this increases the students' levels of stress and fear of contracting the virus in the work environment.^{10,11}

Moving along from psychological health, previous studies have shown that academic stress appears to affect students' physiological and periodontal health, by additional plaque accumulation, gingival inflammation, and increased amounts of interleukins (IL-6 and IL-10) in gingival crevicular fluid and cortisol in saliva, it has been proven to be a result of stress in students.^{12,13}

COVID-19 fatigue or burnout is a type of a chronic stress that puts the population under high stresses for long period of time. The impact of chronic stress contributes to development of oral disease by two pathways; it could lead to individuals enforcing unhealthy habits that foster oral disease and furthermore lead to dysfunction of physiological systems that affect the underlying mechanisms of disease progression.^{14,15}

Also, pathogenic bacteria found in the oral cavity and respiratory tract may endanger dental patients and clinicians. Because of the explicitness of its techniques, which involve direct contact with patients and frequent introduction to salivation, blood, other body liquids, and the treatment of sharp tools, dental consideration settings continually communicate the risk of COVID-19 illness. The significant danger of exposure to COVID-19 during routine dental practice is one of the reasons of concern and stress that dentists experience during this crisis and it had an overwhelming impact on them. It was common to see emotional exhaustion and break down during the pandemic due to this added pressure.¹⁴

The effect of stress on gingival health and the effect of COVID-19 stress on dental student has been studied extensively, but there is lack of evidence on the relationship of academic stress and gingival health in undergraduate dental students during COVID-19 pandemic. To the best of our knowledge, there is no research that has correlated academic stress resulting from COVID-19 and its effect on gingival health specified in undergraduate junior and senior dental students.

This study aimed to assess the relationship between academic stress and gingival health among dental students during the COVID-19 fatigue at Batterjee Medical College, through the following objectives: to assess the gingival health for junior and senior dental students and the effect of academic stress on gingival health during COVID-19 fatigue, and correlate the prolonged period of COVID-19 fatigue with academic stress and gingival health.

Materials and Methods

Participants

Sample Size Calculation

The participants were first-year and fifth-year cohort dental students. We referred to first year as D1 (junior students) and fifth year as the D5 (senior students). The numbers of

enrolled students in D1 were 40 and in D5 were 44 at a total of 84. This number was used as a guide to calculate the sample size needed for this study. We determined the confidence interval at 90% with the margin of error 5%. By using the sample size calculator from the SurveyMonkey website, the minimum effective sample size estimated for the survey was at a total of 38.

Accordingly, 42 participants were included in this study to account for a 10% nonresponse rate. The participants were selected using a convenient sampling method based on preformulated inclusion and exclusion criteria.

Furthermore, to verify, we conducted a power analysis (G power version 3.1 statistical software, Franz Faul, Universität Kiel, Germany) based on previously treated trial cases.¹⁶ An a priori analysis was performed to compute the required sample size-given α , power, and effect size. The input parameters were α error probability of 0.05, an effect size (f) of 0.94, a power of 0.80, and number of groups was two. The findings indicated a minimum sample size of 38 (19 samples for each group).

All students invited to participate in the study were informed that participation was entirely voluntary and they were free to withdraw at any time without affecting their grades or class standing; these students received no financial compensation for their time.

Inclusion Criteria

- A) The study population includes junior and senior year male and female undergraduate dental students.
- B) Systemically free of any diseases or conditions.

Exclusion Criteria

- A) Those who have not undergone periodontal scaling within the previous 6 months.
- B) Individuals with a history of previous periodontal disease.
- C) Patients with a history of systematic antibiotics in the previous 6 months.

Methods

Study Design

A cross-sectional study was conducted on 40 dental students during final exams period at the Dental Clinics of Batterjee Medical College. The study was approved by the college's research ethics committee (IRB#: UB-RES-2022-0003). This study conformed to the Declarations of Helsinki guidelines and all participants provided oral and written informed consent.

Measurements of Dental Academic Stress

To examine the sources of stress related to undergraduate curriculum and training dentistry students, the dental environmental stress referred as (DES) was adapted from the original 38-item DES to be 32-items divided into five areas of potential stressors "Social stressors" (items 1–10), "faculty and administration" (items 11–16), "work-load" (items 17–22), "self-efficacy beliefs" (items 23–27), and "performance pressure" (items 28–32). Six items left out because they were

irrelevant to pre-clinical students. Likert scale was used to rate each item based on respondents: 1 = not stressful, 2 = mildly stressful, 3 = very stressful, and 4 = very stressful. A fifth response ("not pertinent") was included for non-applicable elements.¹⁷

Measurements of COVID-19 Stress

COVID-19 student stress questionnaire (CSSQ) was adapted from the original 7-item to be six items, the item was excluded to accommodate the use of the study and fit the culture of the country. A 5-point Likert scale from zero ("no stress") to 4 ("very stressful") was applied.¹⁸

Measurements of Gingival Health

Gingival Index (GI)¹⁹

It was recorded at four sites (mesiolabial papilla, facial margin, distofacial papilla, and lingual margin of Ramfjord teeth (#16, 12, 24, 36, 32, and 44),²⁰ using a University of Michigan, William's calibration periodontal probe.

The marginal and interproximal tissues were scored separately based on 0 to 3 scores.

The criteria were:

- 0 = Normal gingiva.
- 1 = Mild inflammation—slight change in color and slight edema but no bleeding on probing.
- 2 = Moderate inflammation—redness, edema and glazing, bleeding on probing.
- 3 = Severe inflammation—marked redness and edema, ulceration with tendency to spontaneous bleeding.

Plaque Index (PI)²¹

Coloring agent was used and recorded on Ramfjord teeth.²⁰

The criteria were:

- 0 = No plaque in the gingival area.
- 1 = A film of plaque adhering to the free gingival margin and adjacent area of the tooth. The plaque may only be recognized by running a probe across the tooth surface.
- 2 = Moderate accumulation of soft deposits within the gingival pocket, on the gingival margin and/or adjacent tooth surface, which can be seen by the naked eye.
- 3 = Abundance of soft matter within the gingival pocket and/or on the gingival margin and adjacent tooth surface.

Modified Papillary Bleeding Index (MPBI)^{22,23}

It was visualized by placing the periodontal probe gently in the gingival sulcus at the mesial line angle and was carefully swept forward into the mesial papilla of all teeth present from the second molar to the lateral incisor. Indices were derived for the maxillary left and mandibular right buccal segments, and the maxillary right and mandibular left lingual segments, and from these a full-mouth index was calculated.

They timed the appearance of bleeding and graded it as follows:

- 0 = no bleeding within 30 seconds of probing.
- 1 = bleeding between 3 and 30 seconds of probing.

2 = bleeding within 2 seconds of probing.
 3 = bleeding immediately upon probe placement.

Statistical Analysis

Data were fed to the computer and analyzed using IBM SPSS software package version 20.0. (IBM Corp, Armonk, New York, United States). Categorical data were represented as numbers and percentages. Chi-squared test was applied to investigate the association between the categorical variables. Alternatively, Monte Carlo correction test was applied when more than 20% of the cells have expected count less than five. For continuous data, they were tested for normality by the Kolmogorov–Smirnov test. Quantitative data were expressed as mean, standard deviation and median Student’s *t*-test was used to compare two categories for normally distributed quantitative variables, while significance of the obtained results was judged at the 5% level.

Results

The sociodemographic data of the student population participating in the study are presented in ►Fig. 1, regarding the measurements of dental academic stress, the first category was the social stressors there where a significant increase in some of the social stressors for senior students compared to junior ones as demonstrated in ►Table 1, section A.

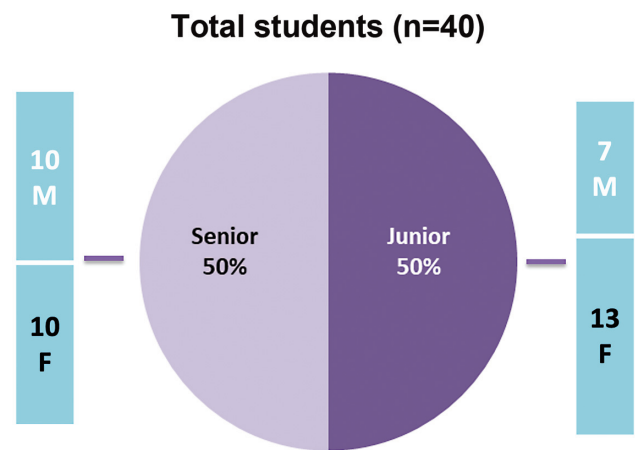


Fig. 1 Sociodemographic characteristics of the participants (n = 40).

In particular; conflict with spouse/mate over career development (*p* = 0.006), having multiple roles (*p* = 0.003), personal physical health (*p* = 0.015), financial responsibilities (*p* = 0.016), and discrimination due to gender or social class (*p* = 0.009), respectively.

The second dental academic stress category was faculty and administration; it witnessed a significant increase in stress in senior over junior students; the most stressful

Table 1 Measurements of dental academic stress comparing between junior and senior students—A: Social stressors category, B: Faculty and administration category, C: Workload category, D: Self-efficacy beliefs category, E: Performance pressure category

A	Social stressors	Total (n = 40)		Year				χ ²	MC <i>p</i>
				Junior (n = 20)		Senior (n = 20)			
		n	%	n	%	n	%		
1	Moving away from home							3.854	0.453
	Not stressful	12	30.0	7	35.0	5	25.0		
	Mildly stressful	11	27.5	4	20.0	7	35.0		
	Stressful	11	27.5	5	25.0	6	30.0		
	Very stressful	1	2.5	0	0.0	1	5.0		
	Not pertinent	5	12.5	4	20.0	1	5.0		
2	Lack of home atmosphere							3.121	0.402
	Not stressful	6	15.0	3	15.0	3	15.0		
	Mildly stressful	12	30.0	6	30.0	6	30.0		
	Stressful	14	35.0	9	45.0	5	25.0		
	Very stressful	8	20.0	2	10.0	6	30.0		
	Not pertinent	0	0.0	0	0.0	0	0.0		
3	Environment in which to study							3.851	0.288
	Not stressful	9	22.5	6	30.0	3	15.0		
	Mildly stressful	8	20.0	5	25.0	3	15.0		
	Stressful	16	40.0	5	25.0	11	55.0		
	Very stressful	7	17.5	4	20.0	3	15.0		
	Not pertinent	0	0.0	0	0.0	0	0.0		

Table 1 (Continued)

A	Social stressors	Total (n = 40)		Year				χ^2	^{MC}p
				Junior (n = 20)		Senior (n = 20)			
		n	%	n	%	n	%		
4	Making friends								
	Not stressful	23	57.5	10	50.0	13	65.0	3.350	0.414
	Mildly stressful	8	20.0	6	30.0	2	10.0		
	Stressful	3	7.5	2	10.0	1	5.0		
	Very stressful	6	15.0	2	10.0	4	20.0		
	Not pertinent	0	0.0	0	0.0	0	0.0		
5	Intimate relationships								
	Not stressful	11	27.5	6	30.0	5	25.0	1.776	0.920
	Mildly stressful	9	22.5	5	25.0	4	20.0		
	Stressful	10	25.0	4	20.0	6	30.0		
	Very stressful	9	22.5	4	20.0	5	25.0		
	Not pertinent	1	2.5	1	5.0	0	0.0		
6	Conflict with spouse/mate over career development								
	Not stressful	9	22.5	8	40.0	1	5.0	13.025 ^a	0.006 ^a
	Mildly stressful	7	17.5	3	15.0	4	20.0		
	Stressful	10	25.0	4	20.0	6	30.0		
	Very stressful	11	27.5	2	10.0	9	45.0		
	Not pertinent	3	7.5	3	15.0	0	0.0		
7	Having multiple roles								
	Not stressful	8	20.0	7	35.0	1	5.0	14.040 ^a	0.003 ^a
	Mildly stressful	15	37.5	8	40.0	7	35.0		
	Stressful	8	20.0	4	20.0	4	20.0		
	Very stressful	8	20.0	0	0.0	8	40.0		
	Not pertinent	1	2.5	1	5.0	0	0.0		
8	Personal physical health								
	Not stressful	13	32.5	11	55.0	2	10.0	10.471 ^a	0.015 ^a
	Mildly stressful	12	30.0	3	15.0	9	45.0		
	Stressful	8	20.0	4	20.0	4	20.0		
	Very stressful	7	17.5	2	10.0	5	25.0		
	Not pertinent	0	0.0	0	0.0	0	0.0		
9	Financial responsibilities								
	Not stressful	12	30.0	8	40.0	4	20.0	11.214 ^a	0.016 ^a
	Mildly stressful	7	17.5	4	20.0	3	15.0		
	Stressful	8	20.0	6	30.0	2	10.0		
	Very stressful	11	27.5	1	5.0	10	50.0		
	Not pertinent	2	5.0	1	5.0	1	5.0		
10	Discrimination due to gender or social class								
	Not stressful	14	35.0	11	55.0	3	15.0	11.044 ^a	0.009 ^a
	Mildly stressful	10	25.0	3	15.0	7	35.0		
	Stressful	11	27.5	6	30.0	5	25.0		
	Very stressful	5	12.5	0	0.0	5	25.0		
	Not pertinent	0	0.0	0	0.0	0	0.0		

(Continued)

Table 1 (Continued)

A	Social stressors	Total (n = 40)		Year				χ^2	^{MC}p
				Junior (n = 20)		Senior (n = 20)			
		n	%	n	%	n	%		
B	Faculty and administration								
11	Expectation vs. reality of dental school								
	Not stressful	3	7.5	2	10.0	1	5.0	6.989	0.062
	Mildly stressful	7	17.5	3	15.0	4	20.0		
	Stressful	15	37.5	11	55.0	4	20.0		
	Very stressful	15	37.5	4	20.0	11	55.0		
	Not pertinent	0	0.0	0	0.0	0	0.0		
12	Approachability of staff								
	Not stressful	8	20.0	7	35.0	1	5.0	9.441 ^a	0.032 ^a
	Mildly stressful	20	50.0	9	45.0	11	55.0		
	Stressful	7	17.5	3	15.0	4	20.0		
	Very stressful	4	10.0	0	0.0	4	20.0		
	Not pertinent	1	2.5	1	5.0	0	0.0		
13	Criticism about academic or preclinical work								
	Not stressful	9	22.5	9	45.0	0	0.0	12.482 ^a	0.004 ^a
	Mildly stressful	9	22.5	3	15.0	6	30.0		
	Stressful	17	42.5	6	30.0	11	55.0		
	Very stressful	5	12.5	2	10.0	3	15.0		
	Not pertinent	0	0.0	0	0.0	0	0.0		
14	Rules and regulations of the dental school								
	Not stressful	10	25.0	10	50.0	0	0.0	16.291 ^a	0.001 ^a
	Mildly stressful	7	17.5	3	15.0	4	20.0		
	Stressful	15	37.5	6	30.0	9	45.0		
	Very stressful	8	20.0	1	5.0	7	35.0		
	Not pertinent	0	0.0	0	0.0	0	0.0		
15	Amount of cheating in school								
	Not stressful	19	47.5	12	60.0	7	35.0	7.892	0.078
	Mildly stressful	4	10.0	2	10.0	2	10.0		
	Stressful	4	10.0	2	10.0	2	10.0		
	Very stressful	9	22.5	1	5.0	8	40.0		
	Not pertinent	4	10.0	3	15.0	1	5.0		
16	Lack of input in decision making process in dental school								
	Not stressful	12	30.0	7	35.0	5	25.0	1.807	0.708
	Mildly stressful	8	20.0	3	15.0	5	25.0		
	Stressful	14	35.0	8	40.0	6	30.0		
	Very stressful	6	15.0	2	10.0	4	20.0		
	Not pertinent	0	0.0	0	0.0	0	0.0		

Table 1 (Continued)

A	Social stressors	Total (n = 40)		Year				χ^2	^{MC}p
				Junior (n = 20)		Senior (n = 20)			
		n	%	n	%	n	%		
C	Workload								
17	Lack of time for relaxation								
	Not stressful	5	12.5	3	15.0	2	10.0	10.548 ^a	0.013 ^a
	Mildly stressful	4	10.0	3	15.0	1	5.0		
	Stressful	13	32.5	10	50.0	3	15.0		
	Very stressful	17	42.5	4	20.0	13	65.0		
	Not pertinent	1	2.5	0	0.0	1	5.0		
18	Having reduced holidays compared with other students								
	Not stressful	6	15.0	2	10.0	4	20.0	9.766 ^a	0.019 ^a
	Mildly stressful	11	27.5	9	45.0	2	10.0		
	Stressful	12	30.0	7	35.0	5	25.0		
	Very stressful	11	27.5	2	10.0	9	45.0		
	Not pertinent								
19	Amount of assigned course work								
	Not stressful	5	12.5	5	25.0	0	0.0	11.865 ^a	0.006 ^a
	Mildly stressful	3	7.5	3	15.0	0	0.0		
	Stressful	15	37.5	4	20.0	11	55.0		
	Very stressful	16	40.0	7	35.0	9	45.0		
	Not pertinent	1	2.5	1	5.0	0	0.0		
20	Lack of time to do assigned school work								
	Not stressful	2	5.0	2	10.0	0	0.0	8.393 ^a	0.022 ^a
	Mildly stressful	8	20.0	4	20.0	4	20.0		
	Stressful	16	40.0	11	55.0	5	25.0		
	Very stressful	14	35.0	3	15.0	11	55.0		
	Not pertinent								
21	Learning precision manual skills required for clinical and laboratory work								
	Not stressful	7	17.5	6	30.0	1	5.0	8.894 ^a	0.048 ^a
	Mildly stressful	13	32.5	7	35.0	6	30.0		
	Stressful	8	20.0	4	20.0	4	20.0		
	Very stressful	11	27.5	2	10.0	9	45.0		
	Not pertinent	1	2.5	1	5.0	0	0.0		
22	Late ending time/completing graduation requirements								
	Not stressful	6	15.0	6	30.0	0	0.0	19.304 ^a	<0.001 ^a
	Mildly stressful	9	22.5	7	35.0	2	10.0		
	Stressful	5	12.5	2	10.0	3	15.0		
	Very stressful	16	40.0	2	10.0	14	70.0		
	Not pertinent	4	10.0	3	15.0	1	5.0		

(Continued)

Table 1 (Continued)

A	Social stressors	Total (n = 40)		Year				χ^2	^{MC}p
				Junior (n = 20)		Senior (n = 20)			
		n	%	n	%	n	%		
D	Self-efficacy beliefs								
23	Language barrier								
	Not stressful	13	32.5	9	45.0	4	20.0	3.291	0.363
	Mildly stressful	9	22.5	3	15.0	6	30.0		
	Stressful	10	25.0	4	20.0	6	30.0		
	Very stressful	8	20.0	4	20.0	4	20.0		
	Not pertinent	0	0.0	0	0.0	0	0.0		
24	Fear of not being able to catch up if falling behind								
	Not stressful	7	17.5	6	30.0	1	5.0	8.487	0.068
	Mildly stressful	5	12.5	2	10.0	3	15.0		
	Stressful	12	30.0	5	25.0	7	35.0		
	Very stressful	13	32.5	4	20.0	9	45.0		
	Not pertinent	3	7.5	3	15.0	0	0.0		
25	Lack of confidence to be a successful dental student								
	Not stressful	13	32.5	10	50.0	3	15.0	7.180	0.066
	Mildly stressful	12	30.0	6	30.0	6	30.0		
	Stressful	9	22.5	3	15.0	6	30.0		
	Very stressful	6	15.0	1	5.0	5	25.0		
	Not pertinent	0	0.0	0	0.0	0	0.0		
26	Uncertainty about dental career								
	Not stressful	10	25.0	5	25.0	5	25.0	19.998 ^a	<0.001 ^a
	Mildly stressful	14	35.0	12	60.0	2	10.0		
	Stressful	5	12.5	3	15.0	2	10.0		
	Very stressful	11	27.5	0	0.0	11	55.0		
	Not pertinent	0	0.0	0	0.0	0	0.0		
27	Lack of confidence to become a successful dentist								
	Not stressful	13	32.5	9	45.0	4	20.0	10.402 ^a	0.013 ^a
	Mildly stressful	8	20.0	6	30.0	2	10.0		
	Stressful	9	22.5	4	20.0	5	25.0		
	Very stressful	10	25.0	1	5.0	9	45.0		
	Not pertinent	0	0.0	0	0.0	0	0.0		
E	Performance pressure								
28	Difficulty of course work								
	Not stressful	8	20.0	7	35.0	1	5.0	11.207 ^a	0.014 ^a
	Mildly stressful	7	17.5	2	10.0	5	25.0		
	Stressful	16	40.0	9	45.0	7	35.0		
	Very stressful	8	20.0	1	5.0	7	35.0		
	Not pertinent	1	2.5	1	5.0	0	0.0		

Table 1 (Continued)

A	Social stressors	Total (n = 40)		Year				χ^2	MC _p
				Junior (n = 20)		Senior (n = 20)			
		n	%	n	%	n	%		
29	Examinations								
	Not stressful	8	20.0	3	15.0	5	25.0	2.336	0.542
	Mildly stressful	8	20.0	3	15.0	5	25.0		
	Stressful	12	30.0	8	40.0	4	20.0		
	Very stressful	12	30.0	6	30.0	6	30.0		
	Not pertinent	0	0.0	0	0.0	0	0.0		
30	Competition for grades								
	Not stressful	2	5.0	1	5.0	1	5.0	0.503	1.000
	Mildly stressful	14	35.0	7	35.0	7	35.0		
	Stressful	13	32.5	7	35.0	6	30.0		
	Very stressful	11	27.5	5	25.0	6	30.0		
	Not pertinent	0	0.0	0	0.0	0	0.0		
31	Fear of failing a course of the year								
	Not stressful	5	12.5	3	15.0	2	10.0	5.159	0.166
	Mildly stressful	4	10.0	4	20.0	0	0.0		
	Stressful	17	42.5	8	40.0	9	45.0		
	Very stressful	14	35.0	5	25.0	9	45.0		
	Not pertinent	0	0.0	0	0.0	0	0.0		
32	Fear of not having possibility to pursue a postgraduate dental education program								
	Not stressful	7	17.5	6	30.0	1	5.0	6.838	0.072
	Mildly stressful	8	20.0	5	25.0	3	15.0		
	Stressful	16	40.0	7	35.0	9	45.0		
	Very stressful	9	22.5	2	10.0	7	35.0		
	Not pertinent	0	0.0	0	0.0	0	0.0		

χ^2 , Chi-squared test; MC, Monte Carlo.

p: p-value for comparing between junior and senior students.

^aStatistically significant at $p \leq 0.05$.

points were approachability of staff ($p=0.032$), criticism about academic or preclinical work ($p=0.004$), and the rules and regulations of the dental school ($p=0.001$) as revealed in ►Table 1, section b. Moreover, the third dental academic stress category that was workload showed statistically significant stresses in all the subcategories for senior students over juniors as presented in ►Table 1, section C.

The fourth dental academic stress category was self-efficacy beliefs that revealed a significant increase in the elements of uncertainty about dental career ($p=0.001$) and lack of confidence to become a successful dentist ($p=0.013$) in senior over junior students as tabulated in ►Table 1, section D.

Difficulty of course work was the major significant stressful point for senior over junior students ($p=0.014$) under the fifth dental academic stress category of performance pressure; the difference in the remaining points under this category was insignificant as presented in ►Table 1, section E.

Regarding the measurements of COVID-19 stress, there was no statistically significant difference between seniors

and juniors in the CSSQ except for one significant question that was “How do you perceive the relationships with your university colleagues during this period of COVID-19 pandemic?” in which the majority of seniors perceived their relationships to be stressful ($p=0.012$) as shown in ►Table 2. Furthermore, the graphical representation of the collective intercategory means of total and percent scores for DES and CSSQ is displayed in ►Fig. 2.

Finally, the assessment of gingival health showed no statistical difference for GI and PI among both student groups, with statistically significance higher levels of MPBI related to junior students as depicted in ►Fig. 3.

Discussion

The COVID-19 pandemic has had a massive impact on majority of the world, and has impacted both physiological and psychological health, placing individuals under tremendous amounts of stress. Even when the epidemic started to

Table 2 Measurements of COVID-19 stress comparing between junior and senior students

Q	Measurements of COVID-19 stress	Total (n = 40)		Year				χ^2	MC_p
				Junior (n = 20)		Senior (n = 20)			
		n	%	n	%	n	%		
1	How do you perceive the risk of contagion during this period of COVID-19 pandemic?								
	Not at all stressful	11	27.5	7	35.0	4	20.0	5.080	0.295
	Somewhat stressful	7	17.5	4	20.0	3	15.0		
	Moderately stressful	10	25.0	6	30.0	4	20.0		
	Very stressful	5	12.5	2	10.0	3	15.0		
Extremely stressful	7	17.5	1	5.0	6	30.0			
2	How do you perceive the condition of social isolation imposed during this period of COVID-19 pandemic?								
	Not at all stressful	9	22.5	6	30.0	3	15.0	8.097	0.078
	Somewhat stressful	14	35.0	10	50.0	4	20.0		
	Moderately stressful	7	17.5	2	10.0	5	25.0		
	Very stressful	6	15.0	1	5.0	5	25.0		
Extremely stressful	4	10.0	1	5.0	3	15.0			
3	How do you perceive the relationships with your relatives during this period of COVID-19 pandemic?								
	Not at all stressful	12	30.0	8	40.0	4	20.0	6.680	0.143
	Somewhat stressful	10	25.0	3	15.0	7	35.0		
	Moderately stressful	9	22.5	6	30.0	3	15.0		
	Very stressful	3	7.5	2	10.0	1	5.0		
Extremely stressful	6	15.0	1	5.0	5	25.0			
4	How do you perceive the relationships with your university colleagues during this period of COVID-19 pandemic?								
	Not at all stressful	19	47.5	14	70.0	5	25.0	11.538 ^a	0.012 ^a
	Somewhat stressful	6	15.0	0	0.0	6	30.0		
	Moderately stressful	7	17.5	3	15.0	4	20.0		
	Very stressful	4	10.0	2	10.0	2	10.0		
Extremely stressful	4	10.0	1	5.0	3	15.0			
5	How do you perceive the relationships with your university professors during this period of COVID-19 pandemic?								
	Not at all stressful	13	32.5	9	45.0	4	20.0	4.894	0.284
	Somewhat stressful	14	35.0	5	25.0	9	45.0		
	Moderately stressful	8	20.0	4	20.0	4	20.0		
	Very stressful	1	2.5	1	5.0	0	0.0		
Extremely stressful	4	10.0	1	5.0	3	15.0			
6	How do you perceive your academic studying experience during this period of COVID-19 pandemic?								

Table 2 (Continued)

Q	Measurements of COVID-19 stress	Total (n = 40)		Year				χ^2	^{MC}p
		n	%	Junior (n = 20)		Senior (n = 20)			
				n	%	n	%		
	Not at all stressful	11	27.5	7	35.0	4	20.0	6.357	0.182
	Somewhat stressful	5	12.5	3	15.0	2	10.0		
	Moderately stressful	10	25.0	2	10.0	8	40.0		
	Very stressful	5	12.5	4	20.0	1	5.0		
	Extremely stressful	9	22.5	4	20.0	5	25.0		

Abbreviations: COVID-19, coronavirus disease 2019; χ^2 , Chi-squared test; MC, Monte Carlo.
 p: p-Value for comparing between junior and senior students.
^aStatistically significant at $p \leq 0.05$.



Fig. 2 Means of total and percent's scores of measurements of dental academic and coronavirus disease 2019 stresses. CSSQ, COVID-19 student stress questionnaire.

gradually fade away, many still suffered from pandemic exhaustion due to the long-term fatigue and it is relation to fear and anxiety during the past 2 years that led to development of chronic fatigue.²

Chronic fatigue has affected dental students along with their academic stress, as they face various challenges and stressful learning environment that require clinical and patient management skills. This unnecessary amount of stress resulting from chronic fatigue in addition to the academic stress made the student vulnerable to periodontal diseases such as gingivitis and periodontitis.¹⁵ The aim of this study was to assess the impact of COVID-19 fatigue and academic stress on the gingival health of dental students at Batterjee Medical College.

Forty dental students participated in this study including 20 junior students and 20 senior students to address the level of stress correlate on the gingival health. Dental school is a stressful environment since senior students have more stress than junior students regarding the curriculum that contains theoretical parts and clinical work as well as their graduation project.⁵

Two questionnaires are given to the participants. First questionnaire was DES that consisted of items that evaluate the stressors of dental training particularly.²⁴ The second questionnaire was CSSQ that developed specifically to access university student's perceived stress during the COVID-19 pandemic.¹⁸

Three indices were applicated to evaluate the gingival health for the participant: GI that relies on visual assessment of gingival changes to measure the severity of inflammation¹⁹ PI was used to evaluate the level and rate of plaque formation on tooth surfaces²¹ the third index was MPBI that was selected because bleeding is considered the first clinical sign of inflammation.^{22,23,25}

Comparing our findings to those of other studies confirmed that the DES showed significant difference in favor of senior students over junior students, possibly due to the more stressful graduation project performed by senior students.^{26,27}

In the cross-sectional study by Ahmad et al,²⁸ the mean GI finding in the preclinical group was 1.13 that was statistically significant for the clinical group with mean of 1.16, while in

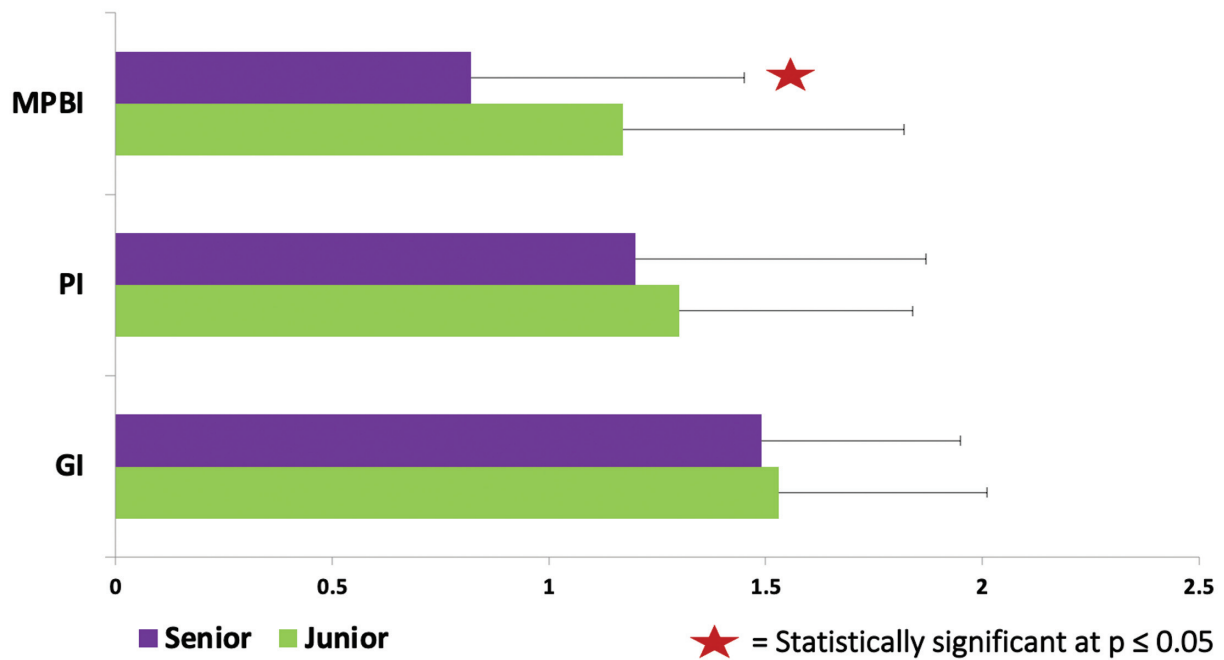


Fig. 3 Means of total and percent’s scores of measurements of gingival health. GI, gingival index; MPBI, Modified Papillary Bleeding Index; PI, plaque index.

this study there were no statistically significant differences, with mean of 1.53 for the preclinical group and 1.49 for the clinical group.

In the study by Ravishankar et al,¹³ PI mean findings of a different group age of dental students before and after exams were 1.213 and 0.845, respectively, when in this study, the PI mean was 1.30 for junior students and 1.20 for senior students during exams.

MPBI showed a statistically significant difference in favor of junior over senior students. In consensus with results of explanations for this result as senior students care about their appearance in front of their patient, they try to be role models of oral care; moreover, dental education improves dental student’s oral health.²⁹

Interestingly CSSQ of this study showed no significant difference in both group with overall low levels of stress, probably due to conduction of this study toward the subsidization of the pandemic in Saudi Arabia, which was consistent with a lift of most governmental measures. This was in contrary to the outcomes of Ammar et al³⁰ who found a psychological impact of COVID-19 pandemic on dental academics.

Even before the discovery of the coronavirus, dentists were always susceptible to infection. They must thus observe extreme caution and handle each individual as a possible risk without adding emotional fatigue to the already-present fear.¹⁴

The limitations of the current study were that the sample size was very limited due to the measurement done during exams and low number of student body in general, social habits like smoking were not specified, lack of use of more specific tools to measure the stress systematically, and finally, there was no baseline to compare to before the pandemic.

Conclusion

Gingival diseases are multifactorial in nature; stress is a biologically influencing factor as well. Despite the evidence of high academic stresses among the dental students, the impact of COVID-19 fatigue on gingival health was inconclusive and slight differences were found between junior and senior year dental students.

Conflict of Interest

None declared.

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