

Oral health habits during COVID-19 pandemic in university medical students

Pierantonio Bellini, Silvia Sabatini, Milena Nasi, Lucia Dall'olio, Luigi Generali, Daniela Mecugni, Ugo Consolo, Anna Vittoria Mattioli

Surgical, Medical and Dental Department of Morphological Sciences related to Transplant, Oncology and Regenerative Medicine, University of Modena and Reggio Emilia, Italy

Abstract. *Background:* The recent coronavirus disease 2019 (COVID-19) pandemic has strongly affected the young population, with a significant impact on their habits. The present study aimed to explore the effects of COVID-19 on oral health and general hygiene habits in a cohort of undergraduate students during the lockdown period in march 2020. *Methods:* A total of 500 under-graduate students with a mean age of 22.84 ± 2.68 years completed an anonymous web survey. We compared 2 groups: students belonging to dentistry and dental hygiene school and students belonged to nursing school. *Results:* The 75 % of students self-reported an increased stress and 80% were concern about the future. A reduction in personal and dental hygiene (8% and 4%, respectively) was observed. Students in dentistry and dental hygiene courses were more careful about their dental hygiene. Interestingly, students from the dentistry and dental hygiene courses reported an increase in the use of chlorhexidine mouthwash during quarantine due both to an increased frequency of use and to a switch to chlorhexidine mouthwash from others type of mouthwash. This change was probably due to the knowledge of some studies that supported the efficacy of chlorhexidine mouthwash in fighting the COVID-19 infection *Conclusion:* Pandemic-related stress has affected our students' population, with changes in general and dental hygiene habits. Strong action must be taken to promote good oral hygiene habits and a healthy lifestyle among the students' population after the COVID-19 pandemic.

Keywords: oral hygiene, COVID-19, pre-graduate students, anxiety, quarantine

Introduction

The coronavirus disease 2019 (COVID-19), caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), originated in December 2019 and has rapidly spread worldwide since then the pandemic severely affected Italy. Reports showing a high number of deaths in early March led the government to enforce a nationwide lockdown. The lockdown was implemented on February 23, 2020, and ended on May, 3 (1). The pandemic and the associated lockdown have strongly affected both general population and the student community (2-7). The ongoing restrictions have limited students' access to university facilities, while the schools have switched to distance learning.

Several studies have explored the psychological effects of the pandemic on students (2-6).

A recent survey of medical students during the Covid-19 pandemic reported an increase in anxiety (61%) and depression (70%) (2). Fear, anxiety, and depression are strongly associated with the development of unhealthy habits characterized by unhealthy diet, reduced physical activity, and increased sitting time (6,7). During the lockdown, individuals switched to an unhealthy lifestyle, including poor diet, reduced physical activity and worsening hygiene behaviors (6-11).

In addition, several oral treatments were delayed during the pandemic. Some hospitals have promoted scientific articles on mass media to educate the public

regarding oral health and strengthening the prevention and treatment of oral diseases (10).

The aim of the present study was to explore the effects of COVID-19 on oral health and general hygiene habits in an undergraduate students' population. This endpoint was explored by comparing students from the dentistry and dental hygiene schools with those from nursing medical school courses.

Material and methods

Participants

After agreeing to an electronic informed consent request, participants completed an anonymous web-based survey from March 24 to May 3, 2020. The survey took 20 min to complete. A total of 500 participants recruited from the university of Modena and Reggio Emilia (Italy), with a mean age of 22.84 ± 2.68 years (range 19–24 years), completed the survey. Two hundred students belonged to the schools of dental hygiene and dentistry, and the remaining 300 belonged to the nursing school. None of the participants reported any symptoms of COVID-19. This was a cross-sectional study.

Questionnaire.

A 34-question, the multiple-choice questionnaire was prepared. After providing informed consent, the participants completed the Google web-based questionnaire. The questionnaire consisted of four sections concerning demographic information, changes in diet, physical activity and sleep during quarantine, ways of coping with the lockdown, and changes in personal and dental hygiene behaviors during quarantine. The questions explored the frequency of tooth brushing, frequency of use of oral mouthwash, type of mouthwash, toothpaste, and toothbrush used before and during quarantine (that is, "how many times a day did you brush your teeth before quarantine?" and "how many times a day did you brush your teeth during quarantine?").

We also asked about self-perception of stress, fear, stigma, and anxiety.

Statistical analysis

Descriptive analyses were performed for all variables. The Shapiro–Wilk test was used to test the normal distribution of continuous variables. We revised the analytical plan after the registration because of differences in age and sex between the cohorts (see Table 1). To determine the differences between the two groups (before and after quarantine) and cohorts (data obtained from the first and second questionnaires), we used the t-test, chi-square test, and Fisher's exact test when appropriate.

Statistical Package for the Social Sciences (SPSS v25) was used for statistical analysis, and a two-tailed p-value < 0.05 was considered significant.

Ethical consideration

No personal or private data were collected. The data collection procedure followed the provisions of the Declaration of Helsinki on human subjects (12). This study was approved by Internal Review Board on March 14, 2020. The ethical characteristics of the study were set out in the presentation of the questionnaire. Indeed, it was stressed that the participant could refuse participation in the protocol whenever they wished. Those interested in participating were given an electronic informed consent form, which recalled the voluntary nature of participation, the confidentiality, and the anonymous nature of the information.

Results

A total of 500 students completed the questionnaire, including 297 (59.4%) women and 203 men (40.6%). The characteristics of the participants are shown in Table 1. As expected, the students self-reported that they suffered from increased stress and emotional distress. (Table 1). The 80% of students were concern about their future.

General hygiene habits were maintained by students, with only a small group that reported a reduction in personal and dental hygiene (8% and 4% of the total population respectively). (Table 2).

Table 1. Baseline characteristics of student populations and perception of stress and stigma during pandemic

	Total population	Dentistry and dental hygiene students	Nursing students
Nr of participants (%)	500	200 (59.4)	300 (40.6)
Mean age	22.84 ± 2.68 (range 19–24 yrs)	21.78 ± 2.75	23.34 ± 2.93
Mean BMI	24.14 ± 4.76	19.84 ± 3.67	22.41 ± 3.12
High level of physical activities (nr of subjects and (%))	103 (20.6)	47 (23.5)	115 (38.3)
Self-perception of increased stress nr of subjects and (%)	376 (75.2)	146 (73)	230 (76)
Self-perception of stigma nr of subjects and (%)	214 (42.8)	83 (41.5)	131 (43.6)
Concern for the future nr of subjects and (%)	401 (80)	143 (71.5)	258 (86)

Table 2. Comparison between dentistry and dental hygiene students and the nursing students.

Question	Answers in all population	Answers in the group of dentistry and dental hygiene students	Answers in the group of nursing students	p value
Did you change your general hygiene habits during quarantine				
No	359 (71.8)	140 (70)	219 (73)	n.s.
Yes wash more frequently	101 (20.2)	41 (20.5)	60 (20)	n.s.
Yes wash less frequently	40 (8)	19(9.5)	21 (7)	n.s.
Did you change your dental hygiene habits during quarantine				
No	399 (79.8)	186 (93)	213 (71)	n.s.
Yes wash more frequently	29 (5.8)	11 (5.5)	18 (6)	n.s.
Yes wash less frequently	72 (4)	3 (1.5)	69(23)	0.01
Frequency of use of mouthwash				
No change	477 (95.4)	190 (95)	287(95.6)	n.s.
Reduction	23 (4.6)	10 (5)	13 (4.3)	n.s.
Frequency in use of floss or interdental brush				
No change	422 (84.4)	185 (92.5)	237(79)	0.05
Reduction	78 (15.6)	15 (7.5)	63 (21)	0.01
Which component is included in your toothpaste				
Fluorides	130 (26)	117 (58.5)	13 (4.3)	0.001
Hydroxyapatite	7 (1.4)	3 (1.5)	4 (1.3)	n.s.
Both	57 (11.4)	56 (28)	1 (0.3)	0.001

(Continued)

None	19 (3.8)	7 (3.5)	12 (4)	n.s.
Don't know	242 (48.4)	15 (7.5)	227 (75.6)	0.001
Don't care	45 (9)	2 (1)	43 (14.3)	0.001
What type of mouthwash you usually use				
Anti-inflammatory	130 (26)	99 (49.5)	31 (10.3)	0.001
Remineralizing	58 (11.6)	21 (10.5)	37 (12.3)	n.s.
Antiseptic	99 (19.8)	55 (27.5)	54 (18)	n.s.
Whitening	66 (13.2)	20 (10)	46 (15.3)	n.s.
None	110 (22)	1 (0.5)	109 (36.6)	0.001
Don't know	24 (4.8)	3 (1.5)	21(7)	0.001
Don't care	3 (0.6)	1 (0.5)	2 (0.6)	n.s.

We then compared students from the dentistry and dental hygiene courses to those from nursing courses (control group). A greater reduction in the frequency of floss or interdental brush use during quarantine was reported in the group of students of nursing school (21% versus 7.5% of the students of dentistry school; $p < 0.01$)

To the question “Which component is included in your toothpaste?”, there was a difference between students from the dentistry and dental hygiene courses to those from nursing courses; a significant greater number of students from the control groups answered “don't know” or “don't care” (respectively: 7.5% versus 75.6%; $p < 0.001$ and 1% versus 14.3%; $p < 0.001$).

To the question “what type of mouthwash do you usually use?” a great number of students from the control group answered “none” (36.6% compared to the dentistry and dental hygiene students where only 0.5% reported not using a mouthwash; $p < 0.01$).

Interestingly, 30 students (15%) from the dentistry and dental hygiene courses reported a change in the quality of mouthwash with an increase in the use of chlorhexidine mouthwash or change habitual mouthwash to chlorhexidine mouthwash during quarantine.

We then correlated self-perception of increase in stress among students because of COVID-19 with all variables related to general and dental hygiene and found a small correlation between COVID-19 stress perception and reduced hygiene.

Discussion

Our study shows that the lockdown in Italy because of the COVID-19 pandemic had a significant impact on both the general and dental hygiene of medical students. We selected this population because we assumed that knowledge of the disease and good hygiene practices (i.e., washing hands frequently or wearing a surgical mask) should have mitigated the negative psychological effects of the Covid-19 pandemic. However, it appears that this was not the case. Despite having a good knowledge of general infectious diseases, stress related to COVID-19 strongly affected the examined population. Self-assessment of stress and anxiety showed that almost all students perceived increased fear, anxiety, and stigma.

To our knowledge, this is the only study that specifically explores the effects of stress that is induced by the COVID-19 pandemic on dental hygiene. On the other hand, several studies have evaluated the impact of COVID-19 and quarantine-related restrictions on student populations (2-6).

Supporting this, Esteves et al. reported that many students changed their lifestyle habits to maintain social distancing, that is, not practicing physical activities and maintaining contact with friends only via telephone (3). Distance learning may have contributed to an increase in lifestyle changes (13,14).

Wilson et al. reported a significant decline in the mental health of college students during the COVID 19

outbreak. In addition, physical activity did not appear to protect against deterioration in mental health (15).

A previous study showed that the lockdown and restrictions imposed by the Italian government produced psychological distress and anxiety symptoms among students, which negatively impacted their sleep quality and sleep hygiene (5).

These results are in agreement with ours; we observed increased anxiety among students leading to unhealthy eating and weight gain, reduced physical activity, and increased sitting time.

A recent manuscript investigated the stigmatizing beliefs and attitudes towards the Anorexia nervosa and Bulimia nervosa, and evaluated how different factors can be associated with different levels of stigma in a sample of Italian nursing students (16). Authors also analyzed the importance of the role played by the mass media that should put a barrier to the canons of body perfection that are spreading is also to be underlined. During pandemic media also contributed to anxiety and stigma and the flow of (mis)information has been identified by the World Health Organization (WHO) and defined as “infodemics” (17).

Medical students appear to be more concerned about personal health than others (18,19). A recent large-scale online survey, found that lockdown measures during the pandemic significantly affected physical activity levels in young adults. Medical students are aware of the importance of physical activity as a major part of long-term disease prevention, which could explain a smaller reduction in physical activity compared to other students and fewer smokers reported in the survey by Steffen J and coworkers (18). Authors stated that the higher rate of SARS-CoV-2-swabs among medical students further supports this assumption but could also be due to contacts to infected patients at the hospital.

Personal hygiene and dental hygiene were maintained during quarantine, with only a small group of students reporting a reduction in personal and dental hygiene. However, when compared the students from dentistry and dental hygiene courses against those from other courses, we observed that the former had better dental hygiene practices. Likewise, they showed better knowledge of the tools used in maintaining oral hygiene.

The persistence of the pandemic appears to have exacerbated the stress-and stress-related lifestyles of students (20-23). Despite efforts to share reliable information on healthy lifestyles, the psychological orientation of young people, particularly their health and food consumption, appears to have not changed during the second wave period (23).

Interestingly, a large number of students from dentistry and dental hygiene courses reported a change in the quality of mouthwash with an increase in the use of chlorhexidine mouthwash during quarantine. This was because of the effect of some studies that supported the efficacy of mouthwash in fighting the COVID-19 infection (24). In the study by Cavalcante-Leao and coworkers, in which the asymptomatic patient has been mentioned multiple times, special attention has been given to dental risk since the epithelial cells of the salivary glands have high expression of the angiotensin-converting enzyme 2 (ACE2) receptor, which is a functional receptor for COVID-19 (24). They systematically reviewed the evidence in the literature regarding the effectiveness of three types of mouthwashes in decreasing the viral load of the oral cavity; the three types of commonly used mouthwashes in dentistry are chlorhexidine, hydrogen peroxide, and povidone-iodine (PVP-I) (24). They concluded that PVP-I, at concentrations of 1% and 7%, appeared to be the most effective mouthwash for reducing SARS-CoV-2 viral load in human saliva (24). However, the level of scientific evidence related to the use of PVP-I mouthwash in reducing SARS-CoV-2 viral load is very low because it was demonstrated only in two *in vitro* studies. The guidelines for dental care refer to the use of hydrogen peroxide; however, there is insufficient scientific evidence to support this recommendation (24-26).

Our study had some limitations. First, the questionnaires were self-administered, and subjective evaluations were described. No validated tools were used to assess stress and depression among students. Second, we used a web-based survey, which may have resulted in possible selection bias. We have selected a cohort of students belonging to the dentistry and dental hygiene school and nursing school; therefore, it is not possible to extend our findings to the general population. However, this very select population of

medical students provides important information on how young individuals perceived the lockdown and the effects it has had on their hygiene habits.

Conclusions

The long-lasting pandemic has led to stress and anxiety among medical pre-graduate students. The restrictions adopted by various governments to reduce the outbreak of infection has strongly affected the youth. School closures, distance learning, and reduced social life may have induced a change in hygiene habits in a negative way, leading to an unhealthy lifestyle among young individuals, including university students. It is known that an unhealthy lifestyle will have long-term effects on non-communicable diseases (27). Besides, it has been previously shown that oral hygiene plays an important role in the prevention of chronic diseases, such as diabetes and cardiovascular diseases (19). In addition, the lack of knowledge of the tools for oral care by students of other medical courses is surprising. All students belonged to the medical field and were expected to have good knowledge about tools for oral care and hygiene. This is an important issue that needs to be addressed by delving into the aspects of oral disease prevention among medical students.

Therefore, future research needs to address new tools and practices that can be used to prevent or reduce the stress the pandemic has created on young people and to encourage healthy practice of dental hygiene.

Acknowledgements: We would like to thank Editage (www.editage.com) for English language editing and Dr. Matteo Ballerini Puviani for statistical analyses.

Compliance with Ethical Standards

Conflict of Interest: All authors declare no conflicts of interest.

Funding: This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

References

1. Government of Italy Decree-Law Number 6 23 February 2020. Available online: <https://www.gazzettaufficiale.it/eli/id/2020/02/23/20G00020/sg>
2. Halperin SJ, Henderson MN, Prenner S, Grauer JN. Prevalence of Anxiety and Depression Among Medical Students During the Covid-19 Pandemic: A Cross-Sectional Study. *J Med Educ Curric Dev.* 2021 Feb 15;8:2382120521991150. doi: 10.1177/2382120521991150. PMID: 33644399; PMCID: PMC7890732.
3. Esteves CS, Oliveira CR, Argimon IIL. Social Distancing: Prevalence of Depressive, Anxiety, and Stress Symptoms Among Brazilian Students During the COVID-19 Pandemic. *Frontiers in Public Health* 2021; 8: 923
4. Bellini P, Iani C, Zucchelli G, et al. Impact of the COVID-19 pandemic on dental hygiene students in the Italian region of Emilia-Romagna. *Minerva Dent Oral Sci.* 2022 Jun;71(3):180-191. doi: 10.23736/S2724-6329.20.04475-1. Epub 2020 Dec 14.
5. Marelli S, Castelnovo A, Somma A, et al. Impact of COVID-19 lockdown on sleep quality in university students and administration staff. *J Neurol.* 2021 Jan;268(1):8-15. doi: 10.1007/s00415-020-10056-6. Epub 2020 Jul 11. PMID: 32654065; PMCID: PMC7353829.
6. Mattioli AV, Nasi M, Cocchi C, Farinetti A. COVID 19 outbreak: impact of the quarantine-induced stress on cardiovascular disease risk burden. *Future Cardiology* Published online: 30 April 2020. Doi: 10.2217/fca-2020-0055
7. Huber BC, Steffen J, Schlichtiger J, Brunner S. Altered nutrition behavior during COVID-19 pandemic lockdown in young adults. *Eur J Nutr.* 2021 Aug;60(5):2593-2602. doi: 10.1007/s00394-020-02435-6. Epub 2020 Dec 1.
8. Torres SJ, Nowson CA. Relationship between stress, eating behavior, and obesity. *Nutrition.* 2007;23(11- 12):887-894. <https://doi.org/10.1016/j.nut.2007.08.008>.
9. Mattioli AV, Sciomer S, Maffei S, Gallina S. Lifestyle and Stress Management in Women During COVID-19 Pandemic: Impact on Cardiovascular Risk Burden. *Am J Lifestyle Med.* 2020 Dec 10;15(3):356-359. doi: 10.1177/1559827620981014. PMID: 34025328; PMCID: PMC8120604.
10. Bayram HM, Ilgaz F, Serel-Arslan S, Demir N, Rakıcioğlu N. The relationship between dysphagia, oral health, masticatory performance and activities of daily living in elderly individuals as assessed by the Eating Assessment Tool. *Progr Nutr* 2021 Mar. 31 [cited 2021 Aug. 4];23(1):e2021005.
11. Bucciarelli V, Nasi M, Bianco F, et al. Depression pandemic and cardiovascular risk in the COVID-19 era and long COVID syndrome: gender makes a difference. *Trends Cardiovasc Med.* 2022 Jan;32(1):12-17. doi: 10.1016/j.tcm.2021.09.009. Epub 2021 Oct 5. PMID: 34619336; .
12. Manti S, Licari A. How to obtain informed consent for research. *Breathe (Sheffield, England).* 2018; 14(2), 145-15. doi:10.1183/20734735.001918

13. Qin Z, Shi L, Xue Y, et al. Prevalence and Risk Factors Associated With Self-reported Psychological Distress Among Children and Adolescents During the COVID-19 Pandemic in China. *JAMA Netw Open*. 2021 Jan 4;4(1):e2035487. doi: 10.1001/jamanetworkopen.2020.35487. PMID: 33496797.
14. Zis P, Artemiadis A, Bargiotas P, Nteveros A, Hadjigeorgiou GM. Medical Studies during the COVID-19 Pandemic: The Impact of Digital Learning on Medical Students' Burnout and Mental Health. *Int J Environ Res Public Health*. 2021 Jan 5;18(1):349. doi: 10.3390/ijerph18010349.
15. Wilson OWA, Holland KE, Elliott LD, Duffey M, Bopp M. The Impact of the COVID-19 Pandemic on US College Students' Physical Activity and Mental Health. *J Phys Act Health*. 2021 Feb 18:1-7. doi: 10.1123/jpah.2020-0325. Epub ahead of print. PMID: 33601332.
16. Lupo R, Zaminga M, Carriero MC, et al. Eating disorders and related stigma: analysis among a population of Italian nursing students. *Acta Biomed*. 2020 Nov 30;91(12-S):e2020011. doi: 10.23750/abm.v91i12-S.10797.
17. Zarocostas J. How to fight an infodemic. *Lancet*. 2020 Feb 29;395(10225):676.
18. Steffen J, Schlichtiger J, Brunner S, Huber BC. Health promoting behaviour of medical versus non-medical students during COVID-19 pandemic: results from the COLA cross-sectional study. *J Transl Med*. 2021 Jun 4;19(1):242. doi: 10.1186/s12967-021-02899-y.
19. Schenkein HA, Papapanou PN, Genco R, Sanz M. Mechanisms underlying the association between periodontitis and atherosclerotic disease. *Periodontol 2000*. 2020 Jun;83(1):90-106. doi: 10.1111/prd.12304.
20. Weingarten HP, Elston D. Food cravings in a college population. *Appetite*. 1991 Dec;17(3):167-75. doi: 10.1016/0195-6663(91)90019-o.
21. Kausche FM, Zerbes G, Kampermann L, Müller JC, Wiedemann K, Büchel C, Schwabe L. Acute stress leaves fear generalization in healthy individuals intact. *Cogn Affect Behav Neurosci*. 2021 Feb 24. doi: 10.3758/s13415-021-00874-0. Epub ahead of print. PMID: 33629258.
22. Mattioli AV, Pinti M, Farinetti A, Nasi M. Obesity risk during collective quarantine for the COVID-19 epidemic. *Obesity Medicine*, 2020 20:100263. doi: 10.1016/j.obmed.2020.100263.
23. Coppi F, Nasi M, Farinetti A, et al. Physical activity, sedentary behaviour, and diet in menopausal women: Comparison between COVID19 "first wave" and "second wave" of pandemic in Italy. *Progress in Nutrition*, 2021, 23(2), 11755 doi: 10.23751/pn.v23i2.11755
24. Cavalcante-Leão BL, de Araujo CM, Basso IB, et al. Is there scientific evidence of the mouthwashes effectiveness in reducing viral load in Covid-19? A systematic review. *J Clin Exp Dent*. 2021 Feb 1;13(2):e179-e189. doi: 10.4317/jced.57406.
25. Alharbi A, Alharbi S, Alqaidi S. Guidelines for dental care provision during the COVID-19 pandemic. *Saudi Dent J*. 2020; 32:181-186
26. Caruso AA, Del Prete A, Lazzarino AI, Capaldi R, Grumetto L. Might hydrogen peroxide reduce the hospitalization rate and complications of SARS-CoV-2 infection? *Infect Control Hosp Epidemiol* 2020;41:1360-1361
27. Mattioli AV, Coppi F, Nasi M, Gallina S. Stress and cardiovascular risk burden after the pandemic: current status and future prospects. *Expert Rev Cardiovasc Ther*. 2022 Jun 23:1-7. doi: 10.1080/14779072.2022.2092097. Epub ahead of print. PMID: 35727895.

Correspondence:

Prof Anna Vittoria Mattioli,
Surgical, Medical and Dental Department of Morphological Sciences related to Transplant, Oncology and Regenerative Medicine
University of Modena and Reggio Emilia,
Via del pozzo, 71 41100 Modena (Italy)
Phone: 0039/59/4224281 Fax: 0039/59/4224323
E-mail: annavittoria.mattioli@unimore.it