ORIGINAL ARTICLE   🔓 Open Access

Pandemic pressure: the impact of COVID-19 on dental students' oral health and well-being in Malaysia

Fara Azwin Adam[1]*, Erni Noor[1], Muhammad Aziq Mohd Azman[2], Muhammad Hazim Mohd Lip[2]

[1]*Center of Periodontology Studies, Faculty of Dentistry, Universiti Teknologi MARA, Jalan Hospital, Sungai Buloh Campus, Sungai Buloh, Selangor 47000, Malaysia.*
[2]*Center of Undergraduate Studies, Faculty of Dentistry, Universiti Teknologi MARA, Sungai Buloh Campus, Jalan Hospital, Sungai Buloh, Selangor 47000, Malaysia.*

Abstract

The COVID-19 pandemic disrupted dental education and affected students' oral health and overall well-being. This study explored the impact of Oral Health-Related Quality of Life (OHRQoL) among Malaysian undergraduate dental students during the pandemic. A cross-sectional study was conducted with 530 students from nine dental schools in Malaysia using the validated Oral Health Impacts Profile-14 (OHIP-14) questionnaire. The OHIP-14 measures functional and psychosocial disabilities caused by oral health issues. The average OHIP-14 score was 10.86 ± 8.47, with 21.3% of students reporting impacts on their OHRQoL. The most affected subscales were psychological discomfort (38.2%), psychological disability (26.9%), and physical pain (22.2%). There were no significant differences in daily performance difficulties between preclinical and clinical students. This study highlights the significant impact of the pandemic on Malaysian dental students' OHRQoL, particularly in psychological and physical aspects. Dental educators and policymakers should prioritize strategies to support students' oral health and overall well-being during such challenging times.

Keywords: COVID-19, dental student, undergraduate, Oral Health-Related Quality of Life (OHRQoL), Oral Health Impact Profile (OHIP-14)

Introduction

COVID-19 has necessitated a paradigm shift in the global educational system with dental schools being no exception. The sudden transition to online learning has posed significant challenges for dental students, who typically require hands-on training in simulation labs and clinical practice (Llanos *et al.*, 2018). Not only did the pandemic hinder dental students from getting adequate hands-on patient training, but preclinical students were also deprived of training on their pre-clinical projects, leaving them unprepared to enter the clinical training years. Learning in dental school could be challenging due to overwhelming clinical and theoretical knowledge.

Oral health is intricately linked with overall health and quality of life (QoL) (Llanos *et al.*, 2018). Several studies consistently demonstrated a correlation between poor oral health and reduced QoL. Good oral health can ensure a good position towards both of the criteria. For example, poor oral

health affects the quality of life and causes psychological stress, contributing to systemic diseases (Vasiliou, 2016). Furthermore, researchers also confirmed that a wide range of severity of periodontal disease could lead to different effects on the quality of life of a person (Llanos *et al.,* 2018).

In recent years, there has been a great interest in researchers finding answers correlating the condition of oral health with a person's quality of life. Oral Health-Related Quality of Life (OHRQoL) is a tool that can evaluate the relationship between oral health and a person's quality of life. OHRQoL considers the subjective point of view of the oral health condition and the personal assessment of the functions, psychology, social, and pain or discomfort (Bennadi & Reddy, 2013). OHIP-14 is a set of questionnaires to appraise the OHRQoL (Skośkiewicz-Malinowska *et al*. 2016).

Quality of life (QoL) is difficult to describe since it should include many facets of life, both subjective and objective, and express a holistic approach to the human person (Bennadi & Reddy, 2013). Several studies on QoL and specific factors comprise this quality in the literature. The literature provides several approaches to this issue, numerous definitions of oral health and QoL, and numerous methods for assessing this concept. The World Health Organization (WHO) defines health as "full physical, mental and social well-being, and not only the absence of disease or illnesses". The WHO defines QOL as "individuals' view of their place in life in the context of the culture and value systems in which they live and in connection to their goals, expectations, standards, and concerns" (Sanders *et al.,* 2009). Oral health-related quality of life is particularly relevant in dentistry (Uzarevic & Bulj,2021). Modern dentistry aims to enhance patients' overall quality of life and dental health. It's crucial to consider the dentist's perspective while evaluating the results of a dental procedure and the patients. This concept has recently emerged in the last several decades and has received minimal attention previously (Gift *et al.,* 1997).

OHRQoL is a multidimensional concept that includes physical, social, and psychological aspects (Slade *et al.*, 1998). Clinical evaluations do not examine these features; only the existence and severity of the disease are recorded, which seldom includes the impact of symptoms on QoL (Gherunpong *et al.*, 2006). OHRQoL is assessed using questionnaires that collect information on oral health and the effects of oral health on QoL. The oral health impact profile (OHIP-14) is one such questionnaire used to assess the impact of oral health on OHRQoL dimensions such as functional limitations, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and social handicap (Slade *et al.*, 1997). According to a five-point Likert scale, the responses included 'very often=5', 'fairly often=4', 'occasionally=3', 'hard=2', 'never=1', or 'don't know=0'. The lower the oral health state, the higher the OHIP-14 score (Slade *et al.*, 1997). They are used to assess the quality of life in certain disease entities or groups of illnesses. The term "health" encompasses biopsychosocial well-being, and dental health can influence numerous facets of QoL (Sheiham, 2005). Despite the increasing research on this topic, few have addressed students as a distinct demographic (Acharya & Sangam, 2008). Such studies enable the investigation of OHRQoL in a group of persons who have received intense training in detecting modest deviations from normalcy and preserving oral health (Harsh *et al.*, 2012). Several studies show that students' views and behaviour toward oral health alter as they proceed through their courses (Rong *et al.*, 2006; Idris *et al.*, 2010).

As we all know, dentistry is a challenging course as dental students are perceived to learn intense theoretical and clinical components (Acharya & Sangam, 2008; Dumitrescu *et al.*, 2007). Knowledge acquisition in every subject in dental school is critical for every undergraduate dental student. In the traditional way of learning, face-to-face lectures, and discussions to explain the theory and clinical practice were done before COVID-19 started. New forms of knowledge are forcing educational institutions to make those processes using

online platforms with many limitations that contribute to students' psychological stress (Gherunpong *et al.*, 2006). Therefore, OHRQoL among undergraduate dental students is essential to determine if their oral health condition affected their effort to cope with studying intense subjects during the pandemic. Good OHRQoL is critical among undergraduate dental students since they play a vital role in a country's future growth, eventually becoming future proponents of social advancement. Understanding students' self-perceptions of oral health, particularly OHRQoL, will provide insights into improved teaching approaches. Additionally, knowing OHRQoL can aid in creating measures to enhance the impact of the curriculum attained as well as the student's health (Acharya & Sangam, 2008). This study aimed to evaluate the effect of OHRQoL among undergraduate dental students in Malaysia and assess if preclinical and clinical Malaysian dental students have any different difficulties in their daily performance during the COVID-19 pandemic.

Materials and Methods

Participants

A cross-sectional study was conducted with undergraduate students from selected universities in Malaysia in 2023, with a sample size of 530 participants. All participants were randomly chosen from six public and three private dental schools and are in their first to fifth year of study, representing both genders. The study was carried out to assess the impact of oral health on the quality of life of these students. The study was conducted following the Declaration of Helsinki, ensuring the protection of the subject's identity. Before participation, informed consent was obtained from all participants at the beginning of the questionnaire. All 530 participants responded and agreed to participate and complete the questionnaire, resulting in a final sample size of a 100% response rate.

Methods

The study was a cross-sectional study. The dean's office of the Faculty of Dentistry at Universiti Teknologi MARA confirmed this study as part of the final year project. Data were collected from undergraduate dental students from selected dental schools in Malaysia. The permission to distribute the questionnaire for selected universities was received from each university's Deputy Dean of Research. Online questionnaires were developed using Google Forms and sent to the representatives from each university via email and social media platforms such as WhatsApp or Telegram. The questionnaires used in this research were validated from a previous study.

This research was designed as a questionnaire that comprises four parts. The first part aimed to gather information on the students' demographics, including their gender, ethnicity, year of study, the dental school they attend in Malaysia, qualification for entering the dental school, and monthly family income. Dentistry undergraduate studies comprise pre-clinical training undertaken during Year-1 and Year-2 before students can enter clinical training in Years 3, 4, and 5. The second part of the questionnaire assessed the students' oral health-related behaviour through a set of questions. The third part involved Slade's short-form instrument, the Oral Health Impact Profile (OHIP-14) (Slade *et al.*, 1997), which has been used to measure how different oral health conditions affect quality of life. This tool evaluated functional and psychosocial disability resulting from an oral health condition during the COVID-19 pandemic. The OHIP-14 questionnaire comprises 14 items investigating functional limitation, physical pain, psychological discomfort, physical and social impairment, and perceived handicap. The participants indicated the frequency of discomfort symptoms on a five-point Likert scale, which includes 'very often=5', 'fairly often=4', 'occasionally=3', 'hard=2', 'never=1', or 'don't know=0'. The OHIP-14 score is higher for individuals with poor oral health status and lower for those with good oral health status. Relevant to this study's purpose,

samples of dental students studying for basic dentistry degree, who underwent non-conventional dental teaching during the Pandemic Covid-19, higher OHIP-14 scores, indicating poorer quality of life during a pandemic, compared with pre-pandemic students (Harsh *et. al.* 2012)

In the pilot study, 20 undergraduate students were recruited to test the methods and assess the questions for the main study. The plans were found to be appropriate and required no changes. The participants were asked to complete the questionnaires on their gadgets and provided a contact number to contact the researchers for any queries. Anonymity and confidentiality were assured, and the participants were given a clear explanation of the study's objectives. Once the questionnaires were completed, the data collection process was initiated immediately through Google Forms, with the data being transferred to Google Sheets.

Result

The research data collected through the questionnaire from Google Forms were processed using IBM SPSS Version 29 on a computer and linked from a Google Sheets database application. To assess the data quality, the collected data were analysed descriptively using mean values, standard deviations, medians, lowest and maximum values, and interquartile ranges. Internal consistency dependability was measured using Cronbach's alpha. Pearson's correlation coefficient determined the correlation between the seven subscale scores and the overall OHIP-14 score. To assess the impact of oral health-related quality of life (OHRQoL), the OHRQoL variable was categorised into two groups: no effect (don't know, never, and hardly ever) and impact (occasionally, reasonably often,

and very often). It is essential to determine the prevalence of the influence of OHRQoL on the entire OHIP-14, as well as its domains and individual items. This will provide a comprehensive understanding of the factors that affect oral health-related quality of life and help identify areas for improvement in future teaching and learning strategies.

Five hundred thirty respondents, of whom 71.5% were female and the remaining 28.5% were male, were involved in the study, as depicted in Table 1. Regarding ethnicity, data from this study showed Malay students were the highest respondents, followed by Chinese, Indian, Bumiputera (Sabah or Sarawak), and others with 64%, 23.6%, 7.9%, 4.0%, and 0.6%, respectively (Table 1).

Universiti Sains Islam Malaysia (USIM) recorded the highest number of respondents (22.45%), followed by Universiti Teknologi MARA (UiTM) and MAHSA International University (MAHSA) with 14.53% and 12.08%, respectively, as seen in Table 1. Further analysis of the respondents of this study which were among the undergraduates of Bachelor of Dental Surgery in Malaysia, projected the highest number in Year 3, with a response rate of 28.9%, followed by the undergraduates in Year 2, year 4 and Year 1 with 25.5%, 25.3%, and 11.5%, respectively. Year-5 dental students recorded the lowest response rate of only 8.9%. Most of the respondents were from foundation studies (65.3%), followed by matriculation (17.5%), A-level (10.4%), STPM (2.5%), and others (4.3%). 37.4% of the respondents recorded a family income of more than RM10970 monthly, 37.0% between RM4851 to RM10970 monthly, 13.4% with a family monthly income between RM2500 to RM4850, and 12.3% with a family monthly income of less than RM2500.

Table 1. Participants' demographic information.

Variable	Number (N)	Percentage (%)
Gender		
Female	9	71.5%
Male	28	28.5%
Ethnicity		
Malay	339	64.0%
Chinese	125	23.6%
Indian	42	7.9%
Bumiputera Sabah/ Sarawak	21	4.0 %
Other	3	0.6 %
Year of Undergraduate study		
Year 1	61	11.5 %
Year 2	135	25.5 %
Year 3	153	28.9 %
Year 4	134	25.3 %
Year 5	47	8.9 %
Universities		
UiTM	13	14.5%
UKM	11	8.3%
USM	8	8.3%
UM	5	8.3%
UIAM	5	10.6%
USIM	5	22.5%
MAHSA	5	12.1%
IMU	5	9.7%
PIDC	5	5.9%
Entry Qualification		
A-Levels	55	10.4%
Foundation	346	65.3%
STPM	13	2.5%
Matriculation	93	17.5%
Others	23	4.3%
Family Income (Monthly)		
<RM2500	65	12.3%
RM2500- RM4850	71	13.4%
RM4851- RM10970	196	37.0%
>RM10970	198	37.4%

The study samples were then required to provide details regarding their oral hygiene behaviour, whereby 95.8% of the respondents recorded brushing their teeth two or more times a day, 3.8% brushing once daily, and 0.2% for both 1-2 times a week and 4-5 times a week (Table 2). On the duration of each brushing, 63.2% of the respondents brushed their teeth for 3 minutes or less, while 31.5% brushed their teeth between 3 and 5 minutes. 5.3% of the respondents recorded brushing their teeth for 5 minutes or more. Of the 530 respondents, 47.4% use toothbrushes and dental floss as their tools for brushing teeth, followed by toothbrushes (32.1%) and a combination of a toothbrush, dental floss, and an interdental brush (9.6%). Interestingly, 1.9% of the respondents out of 530 claimed to wear dentures, while 98.1% did not use dentures, as seen in Table 2.

Table 2. Oral hygiene behaviour.

Variable	Number (N)	Percentage (%)
Frequency of tooth brushing		
1-2 times a week	1	0.2%
2 or more times a day	508	95.8%
4-5 times a week	1	0.2%
Once a day	20	3.8%
Duration of each brushing		
3 minutes or less	335	63.2%
3-5 minutes	167	23.6%
5 minutes or more	28	5.3%
Using Denture		
Yes	10	1.9 %
No	520	98.1 %

Further analysis was done among the ten respondents who wore dentures, four washed their dentures with water and a toothbrush, and four only rinsed with water. One respondent cleaned their dentures using water and a denture cleanser. Another respondent cleaned their dentures with a toothbrush and denture cleanser only.

The study found that 21.3% of the population experienced an adverse impact on their OHRQoL, as seen in Table 3. The mean score on the OHIP-14 was 10.86 ± 8.47, indicating that most oral health conditions did not significantly impact respondents' OHRQoL. The internal consistency of the OHIP-14 score was measured using Cronbach's alpha, which was found to be 0.863, indicating high dependability. The subscales of OHIP-14 also had acceptable internal consistency reliability, with Cronbach's alpha values ranging from 0.424 to 0.712. The total OHIP-14 score was correlated with each of the seven subscales, with a range of correlations from 0.273 to 0.553 (Figure 1). The subscales of psychological discomfort, psychological disability, and physical pain had the most significant impact on the OHRQoL of the respondents, with prevalence rates of the effect of 38.2%, 26.9%, and 22.2%, respectively. On the other hand, the functional limitation subscale had the most negligible impact, with only a 9.5% impact prevalence.

Table 3 presents the prevalence of OHRQoL across individual OHIP-14 items, which ranged from 8.6% (for the OHIP-1 item, "had trouble pronouncing any words because of problems with your teeth, mouth, or dentures" in the functional limitation subscale) to 49.4% (for the OHIP-5 item "felt self-conscious because of problems with

teeth, mouth, or dentures" in the psychological discomfort subscale). Further analysis was done to explore the academic years, preclinical, and clinical influences on Malaysian dental students' daily performance difficulties during the COVID-19 pandemic, as reported in Table 4. It is exciting to note that both clinical and pre-clinical years reported that many respondents for the OHIP-5 item "felt self-

conscious because of problems with teeth, mouth, or dentures" in the psychological discomfort subscale with 16.8 % and 32.6%, respectively. However, to emphasise once again, the average OHIP-14 score was 10.86 ± 8.47, suggesting that most oral health issues did not significantly affect respondents' OHRQoL during the COVID-19 pandemic.

OHIP-14 Subscales	Score				Impact on OHRQOL		Cronbach's Alpha	r
	Mean (SD)	Minimum	Maximum	Median (IQR)	No Impact (%) (answer 0&1)	Impact (%) (answers 2&3&4)		
Functional limitation	0.88 (1.27)	0	8	1(0-2)	90.5	9.5	0.452	0.293
Physical pain	1.55 (1.66)	0	8	2(1-3)	77.8	22.2	0.569	0.409
Psychological discomfort	2.56 (2.08)	0	8	3(2-5)	61.8	38.2	0.569	0.409
Physical disability	1.31 (1.65)	0	8	1(0-2)	82.5	17.5	0.712	0.553
Psychological disability	1.87 (1.78)	0	8	1(0-3)	73.1	26.9	0.424	0.273
Social disability	1.39 (1.61	0	8	1(0-2)	82.4	17.6	0.522	0.360
Social handicap	1.28 (1.54)	0	8	0(0-2)	82.9	17.1	0.533	0.385
OHIP-14 TOTAL	10.86 (8.47)	0	56	10(5-17)	78.72	21.3	0.863	

OHIP-14: Oral Health Impact Profile; n: number of participants; SD: standard deviation; IQR: interquartile range; OHRQoL: oral health-related quality of life; r: Pearson's correlation coefficient; *: statistically significant correlation on $p < 0.05$

Figure 1. Descriptive statistics, internal consistency, and correlation of OHIP-14 subscale scores and total scores among undergraduate dental students from 6 public dental schools and two private dental schools in Malaysia (n = 530).

Table 3. Frequency of impact of each item of the OHIP-14 on OHRQoL among Malaysian university dental students (n = 530).

Response Subscale/item	0- Never		1-Hardly ever		Cumu-lative	2-Occa-sionally		3-Fairly often		4-Very often		Cumu-lative
	n	%	n	%	%	n	%	n	%	n	%	%
Functional limitation												
1. Have you had trouble pronouncing any words because of problems with your teeth, mouth, or dentures?	395	74.5	89	16.8	91.3	31	5.8	10	1.9	5	1.0	8.6
2. Have you felt that your sense of taste has worsened because of problems with your teeth, mouth, or dentures?	342	64.5	133	25.1	89.6	40	7.5	6	1.1	9	1.8	10.4
Physical Pain												
3. Have you had a painful aching in your mouth?	293	55.2	135	25.5	80.7	74	14.0	19	3.6	9	1.7	19.3
4. Have you found it uncomfortable to eat any foods because of problems with your teeth, mouth, or dentures?	273	51.5	124	23.4	74.9	90	17.0	33	6.2	10	1.9	25.1
Psychological discomfort												
5. Have you felt self-conscious because of problems with your teeth, mouth, or dentures?	162	30.6	106	20.0	50.6	105	19.8	93	17.5	64	12.1	49.4
6. Have you felt tense because of problems with your teeth, mouth, or dentures?	239	45.2	148	27.9	73.1	86	16.2	42	7.9	15	2.8	26.9
Physical disabilities												
7. Has your diet been unsatisfactory because of problems with your teeth, mouth, or dentures?	304	57.4	137	25.8	83.2	65	12.3	18	3.4	6	1.1	16.8
8. Have you had to interrupt meals because of problems with your teeth, mouth, or dentures?	321	60.6	113	21.3	81.9	65	12.3	23	4.3	8	1.5	18.1
Psychological disabilities												
9. Have you found it difficult to relax because of problems with your teeth, mouth, or dentures?	281	53.0	138	26.0	79.0	72	13.6	27	5.1	12	2.3	21.0

Item												
10. Have you been a bit embarrassed because of problems with your teeth, mouth, or dentures?	231	43.6	125	23.6	67.2	97	18.3	46	8.7	31	5.8	32.8
Social disabilities												
11. Have you been a bit irritable with other people because of problems with your teeth, mouth, or dentures?	290	54.7	133	25.2	79.9	60	11.3	31	5.8	16	3.0	20.1
12. Have you had difficulty doing your usual jobs because of problems with your teeth, mouth, or dentures?	314	59.2	137	25.8	85.0	58	10.9	14	2.6	7	1.3	15.0
Social handicap												
13. Have you felt that life in general was less satisfying because of problems with your teeth, mouth, or dentures?	281	53.0	120	22.6	75.6	78	14.7	38	7.2	13	2.5	24.4
14. Have you been totally unable to function because of problems with your teeth, mouth, or dentures?	364	68.7	114	21.5	90.2	42	7.9	4	0.8	6	1.1	9.8

OHIP-14: Oral Health Impact Profile; OHRQoL: oral health-related quality of life; n: number of participants

Table 4. Year of studies and frequency of impact of each item of the OHIP-14 on OHRQoL among Malaysian university dental students (n = 530).

Subscale/item	Response	0- Never	1-Hardly ever	Cumulative	2-Occasionally	3-Fairly often	4-Very often	Cumulative
		n	n	N (%)	n	n	n	N (%)
Functional limitation								
1. Have you had trouble pronouncing any words because of problems with your teeth, mouth, or dentures?	Pre-clinical	141	36	177 (33.4)	11	5	3	19 (3.6)
	Clinical	254	53	307 (57.9)	20	5	2	27 (5.1)
2. Have you felt that your sense of taste has worsened because of problems with your teeth, mouth, or dentures?	Pre-clinical	124	50	174 (32.8)	16	3	3	22 (4.2)
	Clinical	218	83	301 (56.8)	24	3	6	33 (6.2)
Physical Pain								
3. Have you had a painful aching in your mouth?	Pre-clinical	110	45	155 (29.2)	30	9	2	41 (7.7)

	Clinical	183	90	273 (51.5)	44	10	7	61 (11.5)
4. Have you found it uncomfortable to eat any foods because of problems with your teeth, mouth, or dentures?	Pre-clinical	100	43	143 (26.9)	36	14	3	53 (10.0)
	Clinical	173	81	254 (47.9)	54	19	7	80 (15.1)
Psychological discomfort								
5. Have you felt self-conscious because of problems with your teeth, mouth, or dentures?	Pre-clinical	70	37	107 (20.2)	34	33	22	89 (16.8)
	Clinical	92	69	161 (30.4)	71	60	42	173 (32.6)
6. Have you felt tense because of problems with your teeth, mouth, or dentures?	Pre-clinical	88	49	137 (25.8)	37	13	9	59 (11.1)
	Clinical	141	99	240 (45.3)	49	29	6	84 (15.8)

Physical disabilities								
7. Has your diet been unsatisfactory because of problems with your teeth, mouth, or dentures?	Pre-clinical	113	49	162 (30.6)	24	6	3	33 (6.2)
	Clinical	190	88	278 (52.5)	41	12	3	56 (10.6)
8. Have you had to interrupt meals because of problems with your teeth, mouth, or dentures?	Pre-clinical	121	42	163 (30.8)	22	9	2	33 (6.2)
	Clinical	200	71	271 (51.1)	43	14	6	63 (11.8)
Psychological disabilities								
9. Have you found it difficult to relax because of problems with your teeth, mouth, or dentures?	Pre-clinical	102	61	163 (30.8)	25	13	5	43(8.1)
	Clinical	179	77	256 (48.3)	47	14	7	68 (12.8)

10. Have you been a bit embarrassed because of problems with your teeth, mouth, or dentures?	Pre-clinical	84	45	129 (24.3)	37	19	11	67 (12.6)
	Clinical	147	80	227 (42.8)	60	27	20	107 (20.2)
Social disabilities								
11. Have you been a bit irritable with other people because of problems with your teeth, mouth, or dentures?	Pre-clinical	101	50	151 (28.4)	23	15	6	44 (8.3)
	Clinical	189	82	271 (51.1)	37	37	10	8415.8)
12. Have you had difficulty doing your usual jobs because of problems with your teeth, mouth, or dentures?	Pre-clinical	110	55	165 (31.1)	26	4	1	41 (7.7)
	Clinical	204	82	286 (53.9)	32	10	6	48 (9.1)

Social handicap								
13. Have you felt that life in general was less satisfying because of problems with your teeth, mouth, or dentures?	Pre-clinical	98	50	148 (27.9)	23	19	6	48 (9.1)
	Clinical	183	70	253 (47.7)	55	19	7	81 (15.3)
14. Have you been totally unable to function because of problems with your teeth, mouth, or dentures?	Pre-clinical	127	51	178 (33.6)	15	1	2	18 (3.4)
	Clinical	237	63	300 (56.6)	27	3	4	34 (6.4)

Discussion

The assessment of Oral Health-Related Quality of Life (OHRQoL) is a vital tool for understanding how oral health affects individuals' well-being across multiple dimensions, such as pain, discomfort, oral function, and social interactions. During the COVID-19 pandemic, studies worldwide reported significant changes in OHRQoL, particularly in populations already experiencing poor oral health. It is important to recognize that oral health problems are often multifactorial, meaning the observed changes in OHRQoL may not be solely caused by the pandemic. This discussion synthesises findings from multiple studies, including research on university students in Croatian and Malaysian populations. It provides a clearer understanding of the pandemic's impact on OHRQoL while acknowledging that other factors beyond COVID-19 may have influenced the results. OHRQoL assessments, such as the Oral Health Impact Profile (OHIP-14), allow healthcare providers to go beyond standard clinical evaluations by including emotional, psychological, and social aspects of oral health (Gherunpong *et al.*, 2006). This comprehensive approach is critical during difficult times like the COVID-19 pandemic when disruptions in dental services and increased stress worsened oral health problems (Tsigarida *et al.*, 2021). For example, a study in Italy showed that people with poor oral health before the pandemic experienced a greater decline in their OHRQoL during the pandemic compared to those with better oral health at baseline.

Several studies have consistently shown that psychological discomfort and physical pain are the most affected dimensions of OHRQoL in young adults. However, whether these changes are directly caused by the COVID-19 pandemic or influenced by other factors, such as stress or pre-existing conditions, is unclear. This distinction is important, as the findings might reflect broader issues rather than pandemic-specific impacts. Uzarevic and Bulj (2021) found that Croatian University students frequently reported psychological discomfort and physical pain, a trend supported by studies from Acharya *et al.* (2008), Gonzales-Sullcahuaman *et al.* (2013), and Silva *et al.* (2010). Similarly, our study showed that Malaysian dental students reported significant impacts on psychological discomfort (38.2%), psychological disability (26.9%), and physical pain (22.2%). These findings align with global studies from India, Iran and Turkey (Sanadhya *et al.*, 2015; Khalighi *et al.*, 2023; Ustaoğlu, *et al.*, 2020), showing that university students are particularly vulnerable to these dimensions, particularly during the pandemic.

The elevated psychological discomfort among dental students can be linked to their increased awareness of oral health, which comes from their training and education, as well as the stress of dental studies. Priya *et al.* (2011) noted that dental students experience high levels of stress and anxiety, making them more sensitive to even minor oral health problems. While these findings are consistent across Croatian and Malaysian students, certain limitations must be addressed. The OHIP-14 tool, though widely used, may not fully capture the complex and multifactorial nature of oral health issues, particularly during the pandemic. Factors like stress, limited access to care, and lifestyle changes could have also influenced OHRQoL outcomes. Additionally, the cross-sectional study design prevents the identification of a clear cause-and-effect relationship between COVID-19 and OHRQoL changes.

Despite these limitations, this study has strengths. It highlights common trends across different populations and emphasises the positive role of good oral health awareness and behaviours among dental students. However, future studies should consider tools that better reflect the multifactorial causes of oral health problems and ensure the validity and reliability of the assessment methods used. Papagiannopolunou *et al.* (2012) similarly reported that individuals with poorer self-assessed oral health had higher OHIP-14 scores, showing a greater impact on their OHRQoL. In this study, the mean OHIP-14 score of 10.86 ± 8.47 among Malaysian

students, which is below the threshold of 14, indicates a low overall impact on daily activities. This result is consistent with Croatian students (Uzarevic & Bulj, 2021). Nevertheless, the extent to which the OHIP-14 instruments comprehensively capture the complex and multifaceted nature of OHRQoL in this study's context remains uncertain, highlighting the importance of selecting well-validated and context-specific tools to ensure the accuracy and reliability of research findings, particularly in the assessment of oral health-related quality of life.

The COVID-19 pandemic increased psychological and emotional challenges related to oral health, especially during lockdowns and movement control orders (MCO). Studies by Elmer et al. (2020) and Kürklü et al. (2017) showed that poor oral health during the pandemic often led to more anxiety, depression, and social isolation. Limited access to dental care during the MCO period worsened the situation, with delays or cancellations of treatments causing uncertainty and frustration. Al-Attar et al. (2021) emphasized that the stress-inducing effects of the pandemic were particularly severe among dental students, noting that tools like the OHIP-14 were often used to measure Oral Health-Related Quality of Life (OHRQoL). It is important to ensure such tools are properly cited and their validity thoroughly discussed to strengthen the findings. However, to accurately assess the direct impact on oral health and, consequently, Oral Health-Related Quality of Life (OHRQoL), it is crucial to identify specific oral health issues caused or worsened by pandemic-related stress. This can be achieved by employing targeted assessments or validated tools that measure the direct effects of stress on oral health, such as bruxism, periodontal issues, or increased dental caries.

Despite the significant impact of psychological discomfort, functional limitations, social handicaps, and physical disability had minimal effects on OHRQoL among Croatian and Malaysian dental students. Uzarevic and Bulj (2021) reported that Croatian students scored lowest on functional limitations, and Malaysian students similarly indicated that their oral health did not affect their ability to speak, taste, or socialise. These low scores could be due to the students' heightened oral health awareness or limitations in the OHIP-14 questionnaire, which may not capture subtle functional or social issues. The low impact on functional and social dimensions can also be explained by dental education programs that promote good oral health habits and strategies to manage stress (Gherunpong et al., 2006). Regular oral care, such as toothbrushing, flossing, and dental check-ups, further contributes to these results (Montero-Martin et al., 2009). Strong support systems from family and peers also help reduce the negative effects of oral health problems (Jaafar & Malik, 2021).

In the context of this study, highlights the multidimensional nature of OHRQoL and its varied impact on university students, especially during the COVID-19 pandemic. Psychological discomfort and physical pain were the most affected areas, while functional and social limitations were less noticeable. This phenomenon could be attributed to the protective role of dental education, which instils in students a deep understanding of the importance of oral health and equips them with the knowledge and skills necessary to maintain good oral hygiene practices, as well as the proactive oral health habits that dental students often adopt as a result of their training, such as regular brushing and flossing and healthy dietary habits which can help to mitigate the negative impacts of oral health problems on their overall quality of life. However, the study has limitations. Oral health issues are influenced by many factors, making it difficult to attribute changes in OHRQoL solely to the pandemic. Additionally, the OHIP-14 tool may not fully capture all relevant impacts, especially in dental students. Despite these limitations, the study's strengths include its focus on young adults, who are more vulnerable to psychological stress, and its cross-cultural approach, which improves the relevance of the findings. Future research should use more targeted tools, address confounding

factors, and include longitudinal studies to better understand the long-term effects of pandemic-related disruptions on OHRQoL. Another limitation of this study is the potential for recall bias among participants, particularly given that the data collection occurred during the endemic phase of COVID-19 in Malaysia. Specifically, some participants may have responded with "Don't know" to certain questions on the Oral Health Impact Profile-14 (OHIP-14) due to difficulties in recalling their experiences during the pandemic. This limitation may be attributed to the challenges of retrospective self-reporting, where participants' ability to accurately recall their past experiences may be compromised. Furthermore, the study's sample population was limited to undergraduate dental students from select dental schools in Malaysia, which may not be representative of the broader population of dental students in the country.

To address these limitations, future studies could consider expanding the sample population to include all undergraduate dental students in Malaysia, as well as postgraduate dental students, to provide a more comprehensive understanding of the impact of COVID-19 on oral health-related quality of life (OHRQoL) among dental students. Additionally, exploring the experiences of postgraduate dental students could provide valuable insights into the potential differences in OHRQoL between undergraduate and postgraduate students, and whether these differences are related to their level of training or other factors. Moreover, conducting similar studies among students from other faculties could provide a more nuanced understanding of the relationship between oral health and quality of life among students in Malaysia, and identify potential areas for targeted interventions. By adopting a more inclusive and diverse sampling strategy, future research could provide a richer and more generalizable understanding of the complex interplay between oral health, quality of life, and the COVID-19 pandemic.

Conclusion

The mean OHIP-14 score obtained in this study suggests that, overall, the oral health of most Malaysian undergraduate dental students did not have a profound impact on their Oral Health-Related Quality of Life (OHRQoL) during the COVID-19 pandemic. This finding is noteworthy, as it implies that despite the challenges and disruptions caused by the pandemic, the oral health of these students did not significantly compromise their daily functioning, social interactions, or overall well-being. Furthermore, the results of this study indicate that there were no significant differences in the difficulties experienced by preclinical and clinical Malaysian undergraduate dental students in their daily performance during the COVID-19 pandemic. This suggests that both preclinical and clinical students were equally resilient in coping with the pandemic-related challenges and that their oral health did not differentially affect their daily activities, regardless of their stage of dental training. These findings have important implications for dental education and practice, as they highlight the importance of promoting oral health awareness and self-care practices among dental students, particularly during times of crisis, to mitigate the potential negative impacts of oral health problems on their quality of life. Overall, this study provides valuable insights into the OHRQoL of Malaysian undergraduate dental students during the COVID-19 pandemic and underscores the need for continued support and resources to ensure the oral health and well-being of this population.

Acknowledgement

Conflict of Interest

The authors declared no competing interest in the study.

Ethical Approval

Before participation, informed consent was obtained from all participants at the beginning of the questionnaire. All 530 participants responded and agreed to participate and complete the questionnaire. The ethical approval to conduct this study was obtained from the ethics committee, Universiti Teknologi MARA (UiTM) Faculty of Dentistry Research Ethics Committee, with the ethical approval number: FRC/03/2022(ERP/20/32).

References

Acharya, S., & Sangam, D.K. (2008). Oral health-related quality of life and its relationship with health locus of control among Indian dental university students. *European Journal of Dental Education*, 12(4), 208-212.

Al-Attar, S., Jiagbogu, M., O'Malley, L., & Lin, Y.L. (2021). Impact of the COVID-19 pandemic on dental students: a cross-sectional study across UK universities. *Faculty Dental Journal*, 12(4), 196-201.

Allison, P.J., Locker, D., Feine, J.S. (2004) Quality of life: a practical guide for the dental clinician. American Dental Association.

Bennadi, D., & Reddy, C.V.K. (2013). Oral health related quality of life. *Journal of International Society of Preventive and Community Dentistry*, 3(1), 1-6. https://doi.org/10.4103/2231-0762.115700

Dumitrescu, A.L., Kawamura, M., & Sasahara, H. (2007). An assessment of oral self-care among Romanian dental students using the Hiroshima University-Dental Behavioural Inventory. *Oral Health & Preventive Dentistry*, 5(2).

Elmer, T., Mepham, K., & Stadtfeld, C. (2020). Students under lockdown: Comparisons of students' social networks and mental health before and during the COVID-19 crisis in Switzerland. *Plos One*, 15(7), e0236337.

Gherunpong, S., Tsakos, G., & Sheiham, A. (2006). A sociodental approach to assessing dental needs of children: concept and models. *International Journal of Paediatric Dentistry*, 16(2), 81-88. https://doi.org/10.1111/j.1365-263x.2006.00701.x

Gift, H.C., Atchison, K.A., & Dayton, C.M. (1997). Conceptualizing oral health and oral health-related quality of life. *Social Science & Medicine*, 44(5), 601-608. https://doi.org/10.1016/s0277-9536(96)00211-0

Gonzales-Sullcahuamán, J.A., Ferreira, F.M., de Menezes, J.V., Paiva, S.M., & Fraiz, F.C. (2013). Oral health-related quality of life among Brazilian dental students. *Acta Odontológica Latinoamericana*, 26(2), 76-83.

Harsh, P., Arunima, C., & Manoj, K. (2012). Oral health quality-of-life among undergraduate Malaysian dental students. *Medical Journal of Malaysia*, 67(3), 299.

Idris, S.H., Shujaat, N.G., Hussain, S.Z., & Chatha, R. (2010). Oral health related quality of life (OHRQoL) in dental undergraduates. *Pakistan Oral and Dental Journal*, 30(2).

Jaafar, A., & Malik, N.A. (2021). Oral Health Literacy and Oral Health Status among Undergraduate University Students. *Journal of Clinical and Health Sciences*, 6(2), 13-22.

Khalifa, N., Allen, P.F., Abu-bakr, N.H., & Abdel-Rahman, M.E. (2013). Psychometric properties and performance of the Oral Health Impact Profile (OHIP-14s-ar) among Sudanese adults. *Journal of Oral Science*, 55(2), 123-132.

Khalighi, H.R., Bigom Taheri, J., Harati, M., Rahimi, M., & Shafiei, S.S. (2023). Impact of Awareness Obtained from Studying Dentistry on Oral Health-Related Quality of Life at Shahid Beheshti University. *Journal of Iranian Medical Council*, 6(3), 433-439.

Llanos, A.H., Silva, C.G.B., Ichimura, K.T., Rebeis, E.S., Giudicissi, M., Romano, M. M., & Saraiva, L. (2018). Impact of aggressive periodontitis and chronic periodontitis on oral health-related quality of life. *Brazilian Oral Research*, 32, e006. https://doi.org/10.1590/1807-3107bor-2018.vol32.0006

Montero Martín, J., Bravo Pérez, M., Albaladejo Martínez, A., Hernández Martín, L.A., & Rosel Gallardo, E. (2009). Validation of the oral health impact profile (OHIP-14sp) for adults in Spain. *Medicina Oral, Patologia Oral, Cirugia Bucal*. 2009, 14(1), 44-50.

Papagiannopoulou, V., Oulis, C. J., Papaioannou, W., Antonogeorgos, G., & Yfantopoulos, J. (2012). Validation of a Greek version of the oral health impact profile (OHIP-14) for use among adults. *Health and Quality of Life Outcomes*, 10, 1-10.

Priya, H., Sequeira, P.S., Acharya, S., & Kumar, M. (2011). Oral health-related quality of life among dental students in a private dental institution in India. *Journal of International Society of Preventive and Community Dentistry*, 1(2), 65-70.

Rong, W.S., Wang, W.J., & Yip, H.K. (2006). Attitudes of dental and medical students in their first and final years of undergraduate study to oral health behaviour. *European Journal of Dental Education*, 10(3), 178-184.

Sanadhya, S., Aapaliya, P., Jain, S., Sharma, N., Choudhary, G., & Dobaria, N. (2015). Assessment and comparison of clinical dental status and its impact on oral health-related quality of life among rural and urban adults of Udaipur, India: A cross-sectional study. *Journal of Basic and Clinical Pharmacy*, 6(2), 50.

Sanders, A.E., Slade, G.D., Lim, S., & Reisine, S. T. (2009). Impact of oral disease on quality of life in the US and Australian populations. *Community Dentistry and Oral Epidemiology*, 37(2), 171-181. https://doi.org/10.1111/j.1600-0528.2008.00457.x

Sheiham, A. (2005). Oral health, general health and quality of life. *Bulletin of the World Health Organization*, 83, 644-644.

Silva, M.E., Villac, E.L., Magalhaes, C.S., Ferreira, E.F. (2010) Impact of tooth loss on quality of life. *Ciencia & Saude Coletiva,* 15(3), 841-850.

Skośkiewicz-Malinowska, K., Noack, B., Kaderali, L., Malicka, B., Lorenz, K., Walczak, K., & Raedel, M. (2016). Oral health and quality of life in old age: a cross-sectional pilot project in Germany and Poland. *Advances in Clinical and Experimental Medicine*, 25(5), 951-959.

Slade, G.D. (1997). Derivation and validation of a short-form oral health impact profile. *Community Dentistry and Oral Epidemiology*, 25(4), 284-290.

Slade, G. D., Strauss, R. P., Atchison, K. A., Kressin, N. R., Locker, D., & Reisine, S. T. (1998). Conference summary: assessing oral health outcomes--measuring health status and quality of life. *Community Dental Health*, 15(1), 3-7.

Tsigarida, A., Mascitti, M., Diolosà, M., Montevecchi, M., Gissi, D.B., De Angelis, F. (2021). Oral Health-Related Quality of Life and its change following full-mouth disinfection and supragingival debridement in periodontally healthy subjects. *Journal of Clinical Medicine.* 10(4), 674.

Ustaoğlu, G., Atala, M.H., & Gümüş, K.Ç. (2020). Evaluation of Oral Health-Related Quality of Life Among Dentistry Students. *Van Tıp Dergisi,* 27(2), 190-196.

Uzarevic, Z., & Bulj, A. (2021). Oral health-related quality of life among Croatian university students. *International Journal of Environmental Research and Public Health*, 18(12), 6483. https://doi.org/10.3390/ijerph18126483

Vasiliou, A., Shankardass, K., Nisenbaum, R., & Quiñonez, C. (2016). Current stress and poor oral health. *BMC Oral Health*, 16, 1-8. https://doi.org/10.1186/s12903-016-0284-y