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## Assessing the Impact of Oral Health-Related Quality of Life Among Periodontal Patients Undergoing Supportive Periodontal Care: A Cross-Sectional Study

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### Abstract

Periodontitis is a chronic inflammatory disease that affects the supporting structures of the teeth, leading to progressive attachment loss and bone destruction. It significantly impacts the quality of life of affected individuals. Despite this, there is a lack of research focused on patients in supportive periodontal care (SPC) within periodontal treatment. This study aimed to determine the impact of periodontitis and other possible factors on oral health-related quality of life (OHRQoL) among patients in SPC using the Malaysian version of the Oral Health Impact Profile (OHIP 14). This study included 219 individuals diagnosed with periodontal disease who had completed active periodontal treatment and were now on regular maintenance. All participants completed the OHIP-14 questionnaire, along with socioeconomic and demographic surveys. A calibrated clinician conducted clinical periodontal examinations to evaluate the patients' current periodontal conditions. The findings indicate that periodontal diseases significantly affect OHRQoL. The OHIP-14 scores were linked to variables such as age, race, educational background, household income, overall health, duration of SPC, and satisfaction levels regarding general oral and periodontal health. The highest OHIP-14 domain scores were for psychological discomfort, followed by functional limitation and physical disability. Discomfort due to food being stuck had the highest mean score of  $2.27 \pm 1.11$ , while avoidance of socializing had the lowest mean score of  $0.48 \pm 0.83$ . Multiple linear regression analyses highlighted that being Malay, medically healthy, and having a higher education level had a more pronounced impact on OHRQoL. These findings underscore the significant negative impact of periodontitis complications on OHRQoL during SPC, with race, medical status, and education level being critical influencing factors.

**Keywords:** Oral Health-Related Quality of Life, Periodontitis, Supportive Periodontal Care



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### Introduction

Periodontitis is a disease characterized by chronic inflammation due to an imbalance between the bacteria's biofilm and the body's immune response (1). Periodontitis, once identified, is a lifelong condition that necessitates patients making a long-term commitment to managing the disease. Severe periodontitis is prevalent worldwide, affecting approximately 19% of those aged 15 years and older (2). In Malaysia, a national oral health survey in 2010 showed that 18.2% of the population experienced severe periodontal disease, with this figure decreasing slightly to 14.5% in 2020 (3).

The clinical manifestations include gingival pain and dentine hypersensitivity, bleeding and swelling, tooth clinical parameters. However, in recent years, there has been a growing emphasis on acknowledging the disease's influence on the functional and psychological well-being of patients (6). This shift in focus has led to the development of a more patient-centered approach in dentistry, where the overall well-being of the patient is prioritized.

A simple patient-reported questionnaire (OHIP-14) is currently the most common research tool to investigate the impact of periodontitis on OHRQoL. This instrument can be used to assess the functional and psychosocial impacts of oral diseases. The OHIP-14 questionnaire, first developed and validated by Slade and Spencer in 1994 (7) has now been utilized for clinical trials and epidemiological surveys across cultures (8-10). It consists of 14 items that cover seven dimensions of OHRQoL, including functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap. It has been found to be a reliable and valid tool for assessing the impact of periodontitis on patients' quality of life in various populations and settings. Several studies using OHIP-14 have shown that periodontitis has a negative impact on patients' quality of life (8, 10, 11). This phenomenon is particularly evident in instances of severe and generalized periodontitis. Furthermore, the study also demonstrated that the management of periodontitis, whether by non-surgical or surgical means, might enhance OHRQoL (12, 13). Most of these studies explored the relationship between OHIP-14 status before and after therapy during the active phase of periodontal disease, when the clinical characteristics are severe. The parameters consist of probing pocket depth (PPD) and bleeding on probing (BoP). As expected, the findings of the studies demonstrated an enhancement in OHRQoL as a result of a significant decrease in symptoms following therapy.

The management of periodontitis comprises multiple phases, with supportive periodontal care (SPC) being one of the crucial components, which focuses on maintaining the achieved periodontal health and preventing further progression of the disease. The SPC begins after the patient is considered periodontally stable. Evaluation of periodontal stability following active therapy is based on clinical parameters and local and systemic risk factors (14-16). Additionally, the new periodontal classification system has defined periodontal stability as having a maximum PPD of 4 mm that does not bleed on probing and having less than 10% BoP (17). Indeed, in this situation, the patient no longer experiences the same issues as they did during the active phase of periodontitis. But do they find the level of periodontal health satisfactory? Previously, it was found that less than 50% of patients in the SPC felt satisfied with their current periodontal condition, and only 31.3% believed that they may have a good to excellent level of periodontal health (18). This demonstrates that other factors influence how periodontal patients perceive their oral health during the SPC. While periodontitis is generally considered stable, it can nevertheless lead to several issues that impact the patient's overall well-being, including

mobility, and drifted teeth, depending on the severity of the disease. Eventually, the disease will lead to tooth loss. All of these symptoms and consequences of periodontitis will have a direct impact on a person's life. In addition to the physical discomfort and functional limitations, periodontitis can also have psychological effects on individuals, such as decreased self-esteem and social anxiety. The World Health Organization (WHO) defines health as "a state of comprehensive physical, mental, and social well-being, rather than simply the absence of disease" (4). On the other hand, oral health can be specifically described as "the holistic perception of the condition of the oral cavity, encompassing its physical, psychological, and social dimensions" (5). The therapy for periodontitis often focuses on the improvement of periodontal recession, tooth drifting, and tooth mobility. Identifying the specific components of oral disease that have the most significant influence on well-being during this phase can assist in determining the most important areas to focus on for prevention and therapy, thus improving patient quality of life. The aim of this study was to explore the relationship between oral health status and oral health-related quality of life in periodontal patients during SPC.

### Materials and Methods

The trial was conducted at the Unit of Periodontology, Mak Mandin Dental Clinic in Penang, Malaysia. The Medical Research and Ethics Committee (MREC) gave the ethical approval (NMRR ID-22-01098-HBE IIR). This cross-sectional study involved periodontal patients who are currently receiving SPC, diagnosed with periodontitis (19), aged 18 years and above, with satisfactory oral function, and plaque accumulation at  $\leq 30\%$  of sites. Subjects were excluded if they had complex dental prostheses, could not hear or comprehend instructions given at the time of the questionnaire administration, were pregnant, or did not consent to the study.

After calculating an initial sample size ( $n_0$ ) of 384 with a confidence level of 95% and a margin of error of 5%, a finite population adjustment was implemented to account for the limited population size of around 450. By substituting the values, the calculated adjusted sample size ( $n$ ) was determined to be around 208. A clinical examination was performed to determine the current periodontal status. The study categorized oral health status variables into "no or yes" based on PPD  $< 4$  mm, PPD = 4 mm with no BoP, PPD  $\geq 5$  mm, BoP  $< 10\%$ , or BoP  $\geq 10\%$ . Three groups were formed: periodontally stable, remission, and recurrence, based on the 2017 classification of periodontal disease (17). The number of teeth was categorized as  $< 20$  teeth or  $\geq 20$  teeth. The presence of root furcation and mobility was sub-categorized into  $< 5$  teeth or  $\geq 5$  teeth, and the severity of hypersensitivity was determined using a visual analogue scale from 0 to 10.

Sociodemographic factors (age, gender, and race), socioeconomic status (education level and household income), smoking, and general health status were used as explanatory variables for the prediction of OHIP-14 and its domains. Sociodemographic factors, socioeconomic status, smoking status, and general health variables were measured through self-report in the questionnaire. Self-reported general oral health measured the self-perception of their general oral and periodontal health and was categorized as "excellent/good, fair, and poor/very poor" (18). The presence of a systemic health problem was dichotomized as "no or yes."

The OHIP-14 Malaysia Version was used to measure the OHRQoL (20). The profile measures the frequency of oral impacts in seven domains: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicap.

Possible OHIP-14 scores ranged from 0 (no problems at all) to 56 (all problems experienced very often). The severity of OHIP-14 scores was calculated, with higher scores indicating worse OHRQoL and lower scores indicating better OHRQoL.

### Clinical measurement

The following clinical measurements were recorded by the two calibrated examiners (EV and SN) using a UNC-15 periodontal probe:

- Full mouth plaque score in percentage.
- Full mouth PPD: probing depths were recorded to the nearest 0.5 mm.
- Full mouth BoP in percentage.
- Tooth mobility (21).
- Furcation involvement (22).

### Calibration of the Examiner

A total of 25 sites with PPD  $\geq$  5mm from 5 non-study subjects with periodontitis were used for calibration exercises. Two qualified examiners (EV and SN) carried out the examination while measuring the PPD. On the same day (with a minimum separation of 15 minutes), the examiner repeated the measurement. After all measurements were taken, the intraclass correlation coefficient (ICC) was used to check the reliability between and within raters. The results indicated good inter-rater agreement (ICC = 0.87) and excellent intra-rater reliability (ICC > 0.90), demonstrating excellent consistency in measurements made by the same examiner over time.

### Data analysis

The data were analyzed using SPSS for Windows version 26 (IBM Corp., Armonk, N.Y., USA) with a 95% confidence interval. Descriptive analysis was employed to summarize key variables. For continuous variables, calculations included the mean, median, standard deviation, and interquartile range, while frequency counts and percentages were used for categorical variables to illustrate the distribution within each category. Dummy

variables were created to represent categorical predictors in the simple and multiple linear regression analyses, which further explored the relationships between significant independent variables and OHRQoL. P-values of  $\leq$  0.05 were considered statistically significant.

### Results

A total of 219 participants were included in this study. Their mean age (SD) was  $49.50 \pm 12.48$  years. They were further divided into several categories based on age group, race, education level, and household income. The definition of household income is taken from the Household Income and Basic Amenities Survey Report 2019, DOSM (23). The OHIP-14 score significantly differed across age groups (P = 0.001), race (P = 0.03), and education level (P < 0.001). Pairwise comparisons were conducted as part of the Kruskal-Wallis test, revealing that participants aged over 60 and between 40 and 59 years old reported lower scores compared to those under 40 (P < 0.001 and P = 0.005, respectively). Only the Malay and Chinese races showed a significant difference (P = 0.027). Additionally, significant differences were observed between secondary or below education level and both diploma (P = 0.003) and degree or higher (P < 0.001), but not between diploma and degree holders (P = 0.785).

For clinical characteristics, the mean duration for patients under SPC was  $3.23 \pm 3.05$  years, and the mean frequency of SPC visits was  $4.38 \pm 2.31$  months. In addition, patients were asked to rate their satisfaction with their general oral health and periodontal health. Only medical status (P = 0.005), duration of SPC (P = 0.025), and self-reported satisfaction with general oral health and periodontal health were statistically significant. Pairwise comparisons revealed that participants who rated their general oral health as excellent reported lower OHIP-14 scores compared to those who rated it as poor (P = 0.001). A similar finding was observed for those who reported satisfaction with their current periodontal health, as they also had lower scores compared to those with poor satisfaction (P = 0.002). Other details are provided in Table 1.

**Table 1:** Socio-demographic, economic characteristics and clinical characteristics of study participants (n = 219)

Variables	Description	Frequency (%)	OHIP-14	
			Mean $\pm$ SD	Median (IQR)
<b>Socio-economic demographic:</b>				
Age group	Under 40	51 (23.29)	20.86 $\pm$ 11.35	24.00 (20.00)**
	40-59	114 (52.05)	15.44 $\pm$ 9.66	14.00 (14.00)
	Over 60	54 (24.66)	12.50 $\pm$ 7.84	12.00 (12.25)
Gender	Male	68 (31.05)	14.50 $\pm$ 9.54	12.00 (13.00)
	Female	151 (68.95)	16.64 $\pm$ 10.28	15.00 (17.00)
Race	Malay	102 (46.58)	17.97 $\pm$ 10.95	16.00 (18.00)*
	Chinese	85 (38.81)	13.67 $\pm$ 8.94	12.00 (12.00)
	Indian	32 (14.61)	15.75 $\pm$ 8.94	14.00 (16.50)

**Table 1:** Socio-demographic, economic characteristics and clinical characteristics of study participants (n = 219) (continued)

Variables	Description	Frequency (%)	OHIP-14	
			Mean $\pm$ SD	Median (IQR)
Education level	Degree or higher	74 (33.79)	18.39 $\pm$ 10.24	16.00 (16.00)**
	Diploma or certificate	52 (23.74)	18.02 $\pm$ 10.33	17.50 (18.00)
	Secondary or below	93 (42.47)	12.91 $\pm$ 9.05	11.00 (13.00)
Household Income	< RM5,000	141 (64.38)	14.91 $\pm$ 9.89	13.00 (15.50)
	RM5,000-RM11,000	59 (26.94)	18.63 $\pm$ 10.43	18.00 (17.00)
	$\geq$ RM11,000	19 (8.68)	15.63 $\pm$ 9.34	14.00 (10.00)
Medical status	Healthy	147 (67.12)	17.31 $\pm$ 10.35	15.00 (16.00)**
	Systemic disease	72 (32.88)	13.25 $\pm$ 8.97	11.00 (12.00)
Smoking status	Never	213 (97.26)	16.15 $\pm$ 10.13	14.00 (16.00)
	Current	6 (2.74)	9.83 $\pm$ 5.85	10.50 (10.50)
<b>Clinical characteristic:</b>				
Periodontal diagnosis	Stage II	6 (2.74)	19.50 $\pm$ 16.33	18.50 (28.00)
	Stage III	175 (79.91)	15.91 $\pm$ 9.88	14.00 (16.00)
	Stage IV	38 (17.35)	15.74 $\pm$ 10.09	15.00 (16.50)
SPC duration	< 5 years	153 (69.86)	17.15 $\pm$ 10.60	16.00 (18.00)*
	$\geq$ 5 years	66 (30.14)	13.26 $\pm$ 8.21	12.00 (9.25)
SPC compliance	Good	94 (42.92)	15.73 $\pm$ 9.62	14.00 (14.50)
	Poor	125 (57.08)	16.16 $\pm$ 10.45	14.00 (16.00)
Recent Periodontal Status**	Stable	34 (15.53)	15.88 $\pm$ 7.68	14.00 (12.25)
	Recurrence	185 (84.47)	15.99 $\pm$ 10.48	14.00 (16.00)
No. of teeth presence	< 20 teeth	20 (9.13)	14.25 $\pm$ 9.82	12.00 (15.50)
	$\geq$ 20 teeth	199 (90.87)	16.15 $\pm$ 10.11	14.00 (16.00)
Mobile teeth	No	110 (50.23)	15.58 $\pm$ 10.56	13.00 (16.25)
	Yes	109 (49.77)	16.38 $\pm$ 9.61	15.00 (17.00)
Teeth with furcation	No	170 (77.63)	15.91 $\pm$ 10.55	14.00 (17.00)
	Yes	49 (22.37)	16.20 $\pm$ 8.36	14.00 (13.50)
Tooth hypersensitivity	No	168 (76.71)	15.70 $\pm$ 9.45	14.00 (15.00)
	Mild (1-3)	26 (11.87)	14.81 $\pm$ 11.60	10.50 (21.50)
	Moderate (4-6)	18 (8.22)	17.89 $\pm$ 11.40	17.00 (20.00)
	Severe ( $\geq$ 7)	7 (3.20)	22.14 $\pm$ 14.60	22.00 (28.00)
<b>Self-reported satisfaction:</b>				
General oral health	Excellent / good	106 (48.40)	14.47 $\pm$ 9.46	12.50 (15.00)*
	Fair	85 (38.81)	16.25 $\pm$ 10.76	13.00 (15.00)
	Poor / very poor	28 (12.79)	20.86 $\pm$ 8.86	21.50 (14.25)
Periodontal health	Excellent / good	112 (51.14)	14.08 $\pm$ 9.18	12.50 (14.00)*
	Fair	84 (38.36)	17.19 $\pm$ 11.01	15.00 (18.75)
	Poor / very poor	23 (10.50)	20.78 $\pm$ 8.73	22.00 (16.00)

SD: Standard deviation, IQR: Interquartile range, RM: Ringgit Malaysia.

\* Variables significant with p-value  $\leq$  0.05, \*\* variables significant with p-value  $\leq$  0.01; Mann Whitney test and Kruskal Wallis test were used as appropriate with Bonferroni correction for multiple comparisons.

\*Remission: n = 0

Mean scores for OHIP-14 and its domains are presented in Table 2. The total OHIP-14 score was 16.08  $\pm$  10.05. Among the domains, psychological discomfort had the

highest mean score, while social disability had the lowest mean score.

**Table 2:** Total and domain scores of OHIP-14 of study participants (n = 219)

Domains	Mean ± SD	Median (IQR)
Functional limitation	1.33 ± 1.11	1 (2.00)
Physical Pain	1.20 ± 1.04	1 (2.00)
Psychological discomfort	1.80 ± 1.31	2 (2.00)
Physical disability	1.23 ± 1.27	1 (2.00)
Psychological disability	0.86 ± 0.95	1 (1.00)
Social disability	0.53 ± 0.83	0 (1.00)
Handicap	1.09 ± 1.16	1 (2.00)
Total OHIP-14	16.08 ± 10.05	14 (16.00)

SD: Standard deviation, IQR: Interquartile range

The item “discomfort due to food stuck (in between teeth)” in the category of psychological discomfort had the highest mean score of  $2.27 \pm 1.11$ , as shown in Table 3. This was followed by “avoidance of specific foods” ( $1.51 \pm 1.30$ ) and “discomfort when eating” ( $1.43 \pm 1.07$ ). Conversely, the mean ratings for “avoid socializing” and “daily activities disturbed” were the lowest, at  $0.48 \pm 0.83$  and  $0.58 \pm 0.87$ , respectively.

**Table 3:** Scores of OHIP-14 for each item of study participants (n = 219)

Domains	Items	Mean ± SD	Median (IQR)
<b>Functional limitation</b>	Chewing difficulty	1.36 ± 1.05	1.00 (2.00)
	Bad breath	1.27 ± 1.17	1.00 (2.00)
<b>Physical Pain</b>	Eating discomfort	1.43 ± 1.07	1.00 (1.00)
	Oral ulcer	0.96 ± 0.93	1.00 (2.00)
<b>Psychological discomfort</b>	Food stuck	2.27 ± 1.11	2.00 (1.00)
	Shy	1.32 ± 1.32	1.00 (2.00)
<b>Physical disability</b>	Avoid eating	1.51 ± 1.30	1.00 (2.00)
	Avoid smiling	0.90 ± 1.15	0.00 (2.00)
<b>Psychological disability</b>	Sleep disturbance	0.73 ± 0.85	1.00 (1.00)
	Concentration disturbance	1.00 ± 1.03	1.00 (2.00)
<b>Social disability</b>	Avoid socialising	0.48 ± 0.83	0.00 (1.00)
	Daily activities disrupted	0.58 ± 0.87	0.00 (1.00)
<b>Handicap</b>	Spending money	1.09 ± 1.09	1.00 (2.00)
	Low confidence	1.07 ± 1.23	1.00 (2.00)

SD: Standard deviation, IQR: Interquartile range

Table 4 presents the results of the simple linear regression analysis, revealing that only age, race, education level, household income, medical status, SPC duration, and self-reported satisfaction with oral health and periodontal health were statistically significant determinants of the OHIP-14, with a p-value ≤ 0.05. The statistically significant variables were further analyzed using multiple linear regression to explore their combined effects.

**Table 4:** Simple linear regression analysis of factors associated with the OHIP-14 of study participants (n = 219).

Variable	Coefficient	SE	t-value	p-value
<b>Age</b>				
Under 40 (Reference)				
40-59	-5.424	1.631	-3.326	0.001
Over 60	-8.363	1.89	-4.424	0.000
<b>Gender</b>				
Male (Reference)				
Female	2.142	1.468	1.459	0.146
<b>Race</b>				
Malay (Reference)				
Chinese	-3.602	1.434	-2.512	0.013
Indian	-2.07	1.977	-1.047	0.296
<b>Education level</b>				
Secondary or below (Reference)				
Diploma or certificate	5.105	1.692	3.017	0.003
Degree or higher	5.478	1.522	3.598	0.001
<b>Household income</b>				
< RM5,000 (Reference)				
RM5,000-RM11,000	3.712	1.55	2.396	0.017
≥ RM11,000	0.717	2.442	0.293	0.769
<b>Medical status</b>				
Healthy (Reference)				
Systemic disease	-3.534	1.403	-2.519	0.013
<b>Smoking status</b>				
Current (Reference)				
Never	6.317	4.16	1.518	0.13

**Table 4:** Simple linear regression analysis of factors associated with the OHIP-14 of study participants (n = 219) (continued).

Variable	Coefficient	SE	t-value	p-value
<b>Periodontal diagnosis</b>				
Stage II (Reference)				
Stage III	-3.591	4.197	-0.856	0.393
Stage IV	-3.763	4.441	-0.847	0.398
<b>SPC duration</b>				
< 5 years (Reference)				
≥ 5 years	-3.399	1.433	-2.372	0.019
<b>SPC compliance</b>				
Good (Reference)				
Poor	0.426	1.379	0.309	0.758
<b>Recent periodontal status</b>				
Stable (Reference)				
Recurrence	0.112	1.885	0.06	0.953
<b>Teeth presence</b>				
≥ 20 teeth (Reference)				
< 20 teeth	-1.901	2.366	-0.803	0.423
<b>Mobile teeth</b>				
No (Reference)				
Yes	0.794	1.364	0.582	0.561
<b>Tooth with furcation</b>				
No (Reference)				
Yes	0.292	1.638	0.178	0.859
<b>Tooth hypersensitivity</b>				
No (Reference)				
Mild (1-3)	-0.889	2.121	-0.419	0.676
Moderate (4-6)	2.192	2.495	0.879	0.381
Severe (≥7)	6.446	3.882	1.661	0.098
<b>General oral health</b>				
Excellent / good (Reference)				
Fair	1.775	1.444	1.23	0.220

**Table 4:** Simple linear regression analysis of factors associated with the OHIP-14 of study participants (n = 219) (continued).

Variable	Coefficient	SE	t-value	p-value
Poor / very poor	6.385	2.107	3.031	0.003
<b>Periodontal health</b>				
Excellent / good (Reference)				
Fair	3.11	1.426	2.181	0.030
Poor / very poor	6.702	2.262	2.963	0.003

SPC: Supportive periodontal care

The results from the multiple linear regression analysis are presented in Table 5. Participants of Chinese descent reported significantly lower OHIP-14 scores compared to Malay participants ( $\beta = -3.223, P = 0.03$ ), while no significant difference was found for Indian participants. Similarly, participants with systemic diseases reported lower OHIP-14 scores compared to systemically healthy participants ( $\beta = -2.977, P = 0.041$ ). Conversely, participants with a degree or higher education level had significantly higher scores compared to those with a secondary education or lower ( $\beta = 4.076, P = 0.018$ ).

**Discussion**

The clinical symptoms of periodontitis are often considered when evaluating patients’ oral health satisfaction. These symptoms include gingival redness and swelling, bleeding during tooth brushing, tooth mobility, pathological tooth migration, and recurrent halitosis. Managing periodontitis, whether through non-surgical or surgical methods, has been shown to effectively address these issues and enhance patients’ quality of life. Needleman et al. found that periodontal patients in the SPC reported better OHRQoL than new patients (24). However, treated periodontitis patients remain vulnerable to other problems that can affect their quality of life, such as tooth sensitivity, difficulty chewing, gingival recession, loose teeth, and spacing. This study found that 12.79% of individuals expressed dissatisfaction with their overall oral health, while 10.50% reported dissatisfaction with their periodontal health. This is lower than previous studies, which indicated that about 58.7% were dissatisfied with their current periodontal health (18). This discrepancy may be related to the level of SPC engagement. A study suggests that patients with good compliance to SPC visits have higher levels of satisfaction and comfort (25). Although this was not evaluated in the previous study, it can be inferred that this phenomenon is likely due to the significant geographical distance from the periodontic center, which limits compliance with SPC visits; 47% of participants reported traveling a minimum distance of 10 km.

**Table 5:** Multiple linear regression analysis of factors associated with the OHIP-14 of study participants (n = 219).

Variable	$\beta$	SE	95% CI		t-value	P-value
<b>Age group</b>						
Below 40 (Reference)						
40-59	-3.151	1.745	-6.591	0.29	-1.805	0.072
Over 60	-4.161	2.21	-8.519	0.197	-1.883	0.061
<b>Race</b>						
Malay (Reference)						
Chinese	-3.223	1.474	-6.129	-0.317	-2.187	0.030
Indian	0.065	2.003	-3.884	4.014	0.033	0.974
<b>Education level</b>						
Secondary or below (Reference)						
Diploma or certificate	3.086	1.72	-0.305	6.478	1.794	0.074
Degree or higher	4.076	1.708	0.707	7.444	2.386	0.018
<b>Medical status</b>						
Healthy (Reference)						
Systemic disease	-2.977	1.445	-5.825	-0.129	-2.061	0.041
<b>SPC duration category</b>						
< 5 years (Reference)						
$\geq$ 5 years	-1.966	1.516	-4.954	1.023	-1.297	0.196
<b>Self-reported satisfaction:</b>						
<b>i. General oral health</b>						
Excellent / good (Reference)						
Fair	1.836	1.927	-1.963	5.634	0.953	0.342
Poor / very poor	3.802	2.792	-1.703	9.307	1.362	0.175
<b>ii. Periodontal health</b>						
Excellent / good (Reference)						
Fair	1.877	1.891	-1.852	5.605	0.992	0.322
Poor / very poor	2.709	2.926	-3.06	8.479	0.926	0.356

SPC: Supportive periodontal care

The present study revealed that psychological discomfort, functional limitations, and physical disability have the greatest influence on patients' OHRQoL. This finding contradicts the results of studies conducted on untreated periodontitis patients, which usually found a greater impact on physical pain and functional limitations but a lower impact on psychological discomfort (26-28). This suggests that post-treatment periodontitis patients may face different challenges in their OHRQoL compared to those with active phase periodontitis. These results align with a previous study conducted among treated periodontitis patients during the Movement Control Order in 2020 by the Malaysian government to prevent the spread of COVID-19 (29). However, that study found that the physical pain domain was the second highest. Due to movement restrictions, it is possible that delays and non-compliance with SPC routines occurred, which may have increased the

risk of recurrence of active disease. In contrast to our study, all patients received SPC every  $4.38 \pm 2.31$  months per year, which may explain the difference in results. Additionally, our findings related to the items in the OHIP-14's domain closely align with prior research. The analysis shows that issues such as food stuck in between teeth avoiding eating, and experiencing discomfort while eating have the greatest influence on participants' OHRQoL. The gingiva is prone to shrinking post-treatment due to reduced inflammation, which is a common and expected consequence of the procedure. This can widen the space between the teeth and open gingival embrasures, commonly referred to as black triangles, which can trap food and be challenging to clean. This may lead to discomfort and possibly pain, prompting patients to avoid specific foods that tend to get stuck in these gaps.

Our research consistently showed that age, race, level of education, household income, medical status, length of SPC, and self-reported satisfaction with oral and periodontal health all have a significant impact on the OHRQoL of periodontitis patients who are on SPC. However, subsequent analysis with multiple linear regression identified education level, race, and medical status as the only variables that remained significant predictors of OHRQoL. Participants with higher education levels had greater OHIP-14 scores, indicating a more significant impact than those with lower education levels. This may be related to the role of education in shaping individuals' perceptions and behaviors towards oral health. It can also be speculated that educated patients who are professionals may be more critical and demanding in their oral care, expecting not only functionality but also higher overall quality. Interestingly, participants with systemic health issues (diabetes mellitus and hypertension) reported better oral health quality than healthy participants in this study. These findings contrast with those of Norwir et al., which showed that periodontitis patients with medical comorbidities have worse OHRQoL (29). This discrepancy could be attributed to various factors, including the low percentage of participants with systemic diseases in the recent study, which stands at 32.88%. Furthermore, the status of these diseases also influences general oral health. Patients with well-controlled and stable diabetes mellitus are less susceptible to the serious consequences of periodontitis. However, no evaluation was conducted to confirm this claim.

Additionally, this study revealed that Malay participants reported a greater impact on their quality of life compared to Chinese participants. While the exact reasons for this are not fully elucidated in this study, it can be speculated that other unmeasured factors, such as oral health literacy, may be involved. Previous research suggests a link between good oral health literacy and regular clinic attendance (30). It appears that participants with poorer OHRQoL were more likely to have problem-oriented dental attendance rather than regular visits (31). It is possible that the Chinese population in this sample had better oral health literacy, contributing to their better-reported OHRQoL. However, this assumption is speculative, as it was not investigated in this study, and there are no existing studies evaluating the level of health literacy among different ethnic groups in Malaysia.

Moreover, this recent study failed to show an association between OHRQoL and periodontal clinical parameters. Factors such as tooth mobility and sensitivity have previously been shown to affect patients' quality of life (32, 33). It is likely that patients have accepted that some of these problems cannot be completely treated, making them less significant at this point in their lives. Additionally, patients may have developed coping mechanisms to manage any discomfort or inconvenience, such as avoiding certain foods or drinks, which may explain the higher impact on the physical disability domain of OHIP-14.

### **Limitation**

While the findings reveal correlations between some variables (race, education level, and systemic health) and the reduced quality of life for periodontitis patients at the SPC, it cannot be concluded that these factors directly cause this outcome. Other factors, such as cultural influences and oral health literacy, may also contribute to these results. Thus, a longitudinal study is needed to provide a better understanding of the causal relationship between the predictors and OHRQoL. Furthermore, the present study population is limited to only one center. Therefore, the generalizability of our results may be restricted. Third, the data related to smoking and medical health were collected through self-reports. It is possible that patients may underreport their smoking habits or medical conditions, leading to potential inaccuracies in the data.

### **Conclusion**

Despite limitations, the findings of this study illustrate the negative impact of periodontitis complications on individual OHRQoL during the SPC. Additionally, the deterioration in OHRQoL showed a significant correlation with a higher level of education.

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### **Competing interests**

The authors declare that they have no competing interests.

### **Ethical Clearance**

We obtained approval from the Medical Research and Ethics Committee (MREC) and the Ministry of Health Malaysia (MOH), registered under NMRR ID-22-01098-HBE IIR.

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