

Effect of a comprehensive plan for periodontal disease care on oral health-related quality of life in patients with periodontal disease in Taiwan

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Abstract

A comprehensive plan for periodontal disease (PD) care in Taiwan provides non-surgical and supportive periodontal treatment. The aim of this study was to determine whether the care plan could improve the oral health-related quality of life of patients with PD.

This study was conducted by purposive sampling and a quasi-experimental design. Patients with PD were assigned to either comprehensive periodontal treatment ($n=32$) or a simple cleaning regimen ($n=32$). Their oral health-related quality of life (OHRQoL) was measured using the Taiwanese version of the Brief World Health Organization Quality of Life (WHOQOL-BREF) scale (general QoL) and the Oral Health Impact Profile (OHIP-14) (OHRQoL). Both scales were completed 14, 28, and 90 days after the initial assessment. The extent of PD in the experimental group was determined again at the end of the study.

On the 28-item WHOQOL-BREF scale, the scores of the experimental group were higher than those of the control group on 5 items and the environmental domain at 14 days. There was a significant improvement in the experimental group on 2 items at 28 days and at 90 days after periodontal treatment (both $P < .05$). No difference was found between the 2 groups in score on the OHIP-14; however, there was a significant improvement in the experimental group in total score at 28 and 90 days after periodontal treatment (both $P < .05$). The number of teeth with probing depth ≥ 5 mm and the percentage of dental plaque were both significantly reduced after the intervention (both $P < .001$).

Patients with a comprehensive plan for PD care showed some improvement in QoL, including in the environmental domain, and on the total score for OHRQoL. Comprehensive periodontal treatment also alleviated periodontal symptoms.

Abbreviations: OHIP-14 = Oral Health Impact Profile, OHRQoL = oral health-related quality of life, WHOQOL-BREF = World Health Organization Quality of Life.

Keywords: Oral Health Impact Profile, oral hygiene, periodontitis, quality of life, WHOQOL-BREF

1. Introduction

The prevalence of periodontal diseases (PD) that includes gingivitis, gum bleeding, calculus, and periodontitis remains high, and approximate 10% to 15% of adults are afflicted by PD, with an increasing prevalence with age and a steep increase at age 30 to 40.^[1] China's third national epidemiological investigation of oral diseases in 2005 revealed that periodontitis affected >50% of the adult Chinese population. In aging populations, 70% to 90% of individuals between 60 and 74 suffered from

PD.^[2] A 2007–2008 survey of periodontal condition and healthcare behavior in Taiwanese adults over the age of 18 showed that 99.2% of this population suffered from some degree of PD and 54.2% had periodontal pockets, but only 28.7% were aware that they had PD.^[3]

PD can have a negative effect on oral health-related quality of life (OHRQoL), reflecting changes at the physiological, psychological, and social levels, and is an important link in a person's overall health status.^[4–9] PD has been linked to such systematic diseases as cardiovascular disease, diabetes, respiratory disease, and osteoporosis, and it may even cause possibly fatal oral infections.^[10–13] It may further increase the risks of premature birth and low body weight infants in pregnant women.^[9]

The diagnosis and treatment of PD is an important and basic step in dental care. The preliminary manifestation of PD is gingivitis, which is caused chiefly by poor oral hygiene, and may cause pain, tooth loosening and loss, difficulty in chewing, and aesthetic problems if not treated promptly.^[9,14] Severe PD may be the cause of 5% to 15% of lost teeth, and tooth loss will give a negative impression, may affect school, work, and everyday household activities, influence psychological and social development, reduce quality of life, and affect treatment of other oral diseases.^[15]

Periodontal maintenance therapy, which includes surgical and non-surgical procedures, has been extensively documented in numerous studies.^[16] A systematic review of the literature by Shanbhag et al^[17] revealed that non-surgical treatment of PD can moderately improve OHRQoL in adults. Similar results have been reported for young adults in India,^[17] adults in Jordan^[18]

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and Turkey,^[19] the elderly in Germany^[20] and post-menopausal women in the United States.^[21] Beginning in 2010, Taiwan implemented a comprehensive plan for PD care supported by the global outpatient dental budget of National Health Insurance. This plan provides comprehensive periodontal treatment, including non-surgical treatment and supportive periodontal treatment.^[22]

Relatively few studies have investigated the association between PD and OHRQoL in Asian populations. A previous study that investigated the relationships between periodontal conditions and OHRQoL among pregnant women in China found no impact of periodontal health status on their oral health-related quality of life.^[23] Another study that evaluated the association of periodontal health and OHRQoL in Chinese patients with chronic obstructive pulmonary disease suggested that poor periodontal health as reflected by missing teeth and plaque index was significantly associated with lower QoL.^[24] No similar study has been conducted among Taiwanese periodontal patients. We hypothesized that a comprehensive plan for PD care could improve OHRQoL and effectively treat or alleviate PD.

The aims of this study were to gain an understanding of the distribution of demographic variables, oral healthcare habits, oral examination status, and QoL among patients with PD in a plan for comprehensive PD care; and to compare QoL before and after receiving comprehensive periodontal treatment.

2. Methods

2.1. Subjects

This study employed purposive sampling and a quasi-experimental design to ensure that there would be no interaction between the experimental and control groups. Therefore, this study enrolled the control group only after the experimental group was completely enrolled. All subjects were enrolled at the primary-level dental clinics in New Taipei and Taipei City which participated in the National Health Insurance Comprehensive Periodontal Disease Care Plan from December 2014 to June 2016. Eligible patients in the care plan were patients with whole-mouth periodontitis, with a total of at least 16 teeth (teeth considered by a professional dentist to require resolution were not included in the calculation of the number of teeth), and at least 6 teeth with a periodontal pocket depth ≥ 5 mm. Patients were included if they were at least 20 years of age; able to complete the study's questionnaire survey; had not received subgingival curettage or a periodontal flap operation within the previous 1-year period. Patients were excluded if they were aboriginal people in Taiwan or difficult to communicate with the investigators; cognitively impaired; pregnant women; persons with head or neck cancer. A total of 32 patients were enrolled in each group. This study was approved by the Institutional Review Board of National Yang Ming University (project no.: YM103057E).

2.2. Sample size

The power analysis with $\alpha = 0.05$, power of 0.80, and expected effect size of 0.3 was done with G*Power 3.1.9.2 software (Heinrich-Heine-University Dusseldorf, Dusseldorf, Germany), resulting in an indicated sample size of 31. In consideration of loss to follow-up, we recruited 40 patients for each group. At the beginning of the study, we actually recruited 41 patients in the experimental group and 36 in the control group. During the study period, 9 patients in the experimental group and 4 in the control

group were lost to follow-up. Therefore, 64 patients (32 in each group) were included in the final analysis.

2.3. Instruments

For the QoL scale, we selected the Taiwanese version of the World Health Organization Questionnaire-Brief (WHOQOL-BREF) for general QoL and the 14-question Oral Health Impact Profile (OHIP-14) for OHRQoL. The Taiwanese version of the WHOQOL-BREF was validated by Yao et al.^[25] This scale has 28 questions in physical, psychological, social, and environmental domains. Higher scores indicate a better quality of life.^[26] The OHIP-14 scale has 14 questions in the areas of functional limitations, physical pain, psychological pain, physical limitations, psychological limitations, social limitations, and accessibility. The Taiwanese version of the OHIP-14 was validated by Kuo et al. (2011).^[27] The items on the OHIP were problems related to oral health. OHIP question responses used a 5-point Likert scale, indicating a problem's frequency: "very often" (score 4), "often" (score 3), "occasionally" (score 2), "rarely" (score 1), or "never" (score 0) during the previous 12 months. Therefore, higher scores indicate a poorer quality of oral health.^[27]

2.4. Procedure

The instruments were self-completed structured questionnaires. The participants completed the questionnaires in a waiting room next to the dental clinic. If participants were unclear about the meaning of a question, they could ask for clarification. All subjects signed informed consent forms and completed both the WHOQOL-BREF and OHIP-14 scales at the time of diagnosis (baseline evaluation). After diagnosis, the participants were asked if they were willing to join the Comprehensive Periodontal Disease Care Plan (experimental group). The experimental group received comprehensive non-surgical periodontal treatment which included 3 steps: Step 1—dental examination and oral hygiene education including a brochure describing the plan for comprehensive PD; Step 2—periodontal treatments, including subgingival curettage and root planing (supportive therapy); Step 3—evaluation of the effectiveness of the comprehensive periodontal treatment. The registration fees were waived as an incentive to continue in the project. The experimental group completed both scales again at 28 days and at 90 days after the beginning of comprehensive periodontal treatment. Participants who were not willing to accept the periodontal care plan were assigned to the control group. Control group subjects received no periodontal treatment other than dental scaling during the case acceptance period. The control group completed both scales at the time of diagnosis (baseline evaluation), and completed both scales again at 14 days after the first examination. We asked for a second visiting at 14 days after the first examination because we still tried to convince the participants in control group as early as possible to change their minds about receiving the comprehensive periodontal treatment. None did after the second visiting. Follow-up questionnaires were mailed to those who had failed to keep an appointment.

2.5. Statistical analysis

Continuous variables were shown as mean \pm SD and categorical variables as n (%). Differences between groups were compared using independent 2-sample *t* tests and chi-squares for continu-

ous variables and categorical ones, respectively. For categorical data, Fisher's exact test was used instead for any cell numbers having expected values <5 . Moreover, a paired sample *t* test was performed to compare the differences in quality of life before and after intervention within groups. Multiple linear regression was used to examine the association between quality of life as indicated on the OHIP-14 and WHOQOL-BREF and the intervention adjusted for age and gender. All statistics were 2-tailed and $P < .05$ was considered statistically significant. All statistics were performed using SAS 9.4 statistical software (SAS Institute Inc., Cary, NC).

3. Results

Participants' demographic and clinical characteristics, life style (e.g., smoking drinking), oral health and PD symptoms, and oral health habits are shown in Table 1. There were 47% and 63% males in the experimental and control groups, respectively. The mean age of participants was higher in the experimental group (51.03 ± 10.35 years) than in the control group (42.88 ± 12.78) ($P = .007$), suggesting that there was no match in age between the group due to the quasi-experimental design. No patient with hepatitis was found in the experimental group, and no patient with diabetes or gastrointestinal disease was found in the control group. There were no statistical differences in life style between the 2 groups, including smoking, betel nut chewing or drinking ($P = .776, .750, \text{ and } .400$, respectively). All oral health and PD symptoms, and oral health habits were also not statistically different between groups (Table 1).

3.1. WHOQOL-BREF

Table 2 shows the scores on the WHOQOL-BREF Taiwan Version in the 2 groups before and after the intervention. Before the intervention, the baseline score showed a significant difference between 2 groups in "How satisfied are you with your transport?" (item #25) (4.00 ± 0.57 in the experimental group vs 3.66 ± 0.55 in the control group; $P = .016$) and "How often do you have negative feelings such as blue mood, despair, anxiety, or depression?" (item #26) (2.34 ± 0.70 in the experimental group vs 2.72 ± 0.77 in the control group; $P = .046$). On item #26, a higher score indicated less satisfaction. Therefore, patients in the experimental group had fewer negative feelings such as blue mood, despair, anxiety, or depression.

The 28 day score showed significant differences between the 2 groups on "To what extent do you feel your life to be meaningful?" (item #6) (3.88 ± 0.87 in the experimental group vs 3.41 ± 0.91 in the control group; $P = .040$), "How well are you able to get around?" (item #15) (4.25 ± 0.75 in the experimental group vs 3.78 ± 0.83 in the control group; $P = .011$), "How satisfied are you with your capacity for work?" (item #18) (3.88 ± 0.66 in the experimental group vs 3.47 ± 0.84 in the control group; $P = .036$), "How satisfied are you with your personal relationships?" (item #20) (3.91 ± 0.59 in the experimental group vs 3.56 ± 0.76 in the control group; $P = -.047$) and "How satisfied are you with your sex life?" (item #21) (3.63 ± 0.66 in the experimental group vs 2.94 ± 1.16 in the control group; $P = .005$).

We did find significant improvement in the experimental group on 2 items after comprehensive periodontal treatment for 28 and 90 days. These were "How satisfied are you with your health?" (item #2) and "To what extent do you feel your life is meaningful?" (item #6). "How satisfied are you with your personal relationships?" (item #20) also improved significantly in

Table 1

Demographic and oral clinical characteristics of the experimental and control groups.

	Experimental group N=32	Control group N=32	P
Demographics and clinical characteristics			
Males (%)	15 (46.88)	20 (62.50)	.209
Age, years	51.03 ± 10.35	42.88 ± 12.78	.007
Clinical history of disease			
Hypertension	5 (15.63)	5 (15.63)	1.000
Diabetes	4 (12.50)	0 (0.00)	.113
Heart disease	2 (6.25)	1 (3.13)	1.000
Respiratory disease	1 (3.13)	1 (3.13)	1.000
Gastrointestinal disease	3 (9.38)	0 (0.00)	.238
Hepatitis	0 (0.00)	2 (6.25)	.492
Gout	1 (3.13)	1 (3.13)	1.000
Osteoporosis	2 (6.25)	1 (3.13)	1.000
Relative with PD			
No	9 (28.13)	6 (18.75)	
Yes	7 (21.88)	13 (40.63)	
Unknown	16 (50.00)	13 (40.63)	
Dry mouth	12 (37.50)	16 (50.00)	.314
Life style			
Smoking			
No	20 (62.50)	17 (53.13)	
Yes, but quit	4 (12.50)	5 (15.63)	
Yes	8 (25.00)	10 (31.25)	.776
Betel nut			
No	27 (84.38)	25 (78.13)	
Yes, but quit	5 (15.63)	6 (18.75)	
Yes	0 (0.00)	1 (3.13)	.750
Drinking			
No	10 (31.25)	10 (31.25)	
Yes, but quit	8 (25.00)	4 (12.50)	
Yes	14 (43.75)	18 (56.25)	.400
Oral health and PD symptoms			
Total number of teeth	26.34 ± 3.26	25.78 ± 3.08	.480
Probing depth ≥5 mm (numbers of teeth)	13.91 ± 7.27	11.03 ± 6.56	.102
Dental plaques, %	80.34 ± 13.67	79.38 ± 15.40	.791
Loose teeth	17 (53.13)	15 (46.88)	.617
Gums that bleed easily	21 (65.63)	16 (50.00)	.206
Sensitive gums	17 (53.13)	14 (43.75)	.453
Receding gums or longer appearing teeth	14 (43.75)	14 (43.75)	1.000
Red or swollen gums	2 (6.25)	3 (9.38)	1.000
Persistent bad breath or bad taste	10 (31.25)	11 (34.38)	.790
Any change in the way your teeth fit together when you bite	10 (31.25)	8 (25.00)	.578
Any change in the fit of partial dentures			
No	14 (43.75)	10 (31.25)	
Yes	2 (6.25)	3 (9.38)	
Not applicable	16 (50.00)	19 (59.38)	.632
Oral health habits			
Frequency of brushing teeth	2.19 ± 1.09	2.03 ± 0.93	.540
Habit of using dental floss			
Never	7 (21.88)	3 (9.38)	.302
At the time food slips between the teeth	13 (40.63)	16 (50.00)	.451
2–3 times per month	0 (0.00)	1 (3.13)	1.000
2–3 times per week	2 (6.25)	1 (3.13)	1.000
Everyday	13 (40.63)	13 (40.63)	1.000
Habit of dental cleaning in clinic	15 (46.88)	10 (31.25)	.200

Data are shown as mean ± SD for continuous data or n (%) for categorical data.

Bold value indicates significance (P value $< .05$).

PD = periodontal disease.

the experimental group after 28 days. The pooled scores of the 4 domains showed no significant difference between groups before and after the intervention. On the Environmental domain score (domain 4), there was a significant difference on the second score between the groups (14.49 ± 1.64 in the experimental group vs 13.57 ± 1.92 in the control group; $P = .044$), suggesting that comprehensive periodontal treatment had a beneficial effect on environment-related quality of life.

Table 2**Scores on the WHOQOL-BREF Taiwan Version in the 2 groups before and after intervention[§].**

Item no.	Description of items	Before intervention (1st score)			2nd score [¶]			3rd score [¶]
		Experimental group (N=32)	Control group (N=32)	P	Experimental group (N=32)	Control group (N=32)	P	Experimental group (N=32)
1	How would you rate your quality of life?	3.56 ± 0.67	3.22 ± 0.71	.050	3.59 ± 0.71	3.28 ± 0.63	.510	3.59 ± 0.87
2	How satisfied are you with your health?	3.09 ± 0.73	3.16 ± 0.77	.740	3.41 ± 0.71[†]	3.09 ± 0.69	.079	3.34 ± 0.94[†]
3	To what extent do you feel that physical pain prevents you from doing what you need to do? [‡]	2.50 ± 0.98	2.28 ± 0.92	.363	2.31 ± 0.93	2.25 ± 0.95	.791	2.31 ± 0.90
4	How much do you need any medical treatment to function in your daily life? [‡]	1.75 ± 0.84	1.72 ± 0.92	.888	1.75 ± 0.92	1.78 ± 0.97	.895	1.81 ± 1.03
5	How much do you enjoy life?	2.88 ± 0.87	2.69 ± 0.86	.389	2.91 ± 1.06	2.81 ± 0.78	.688	3.47 ± 0.80
6	To what extent do you feel your life is meaningful?	3.63 ± 0.98	3.31 ± 1.00	.210	3.88 ± 0.87[†]	3.41 ± 0.91	.039*	3.88 ± 0.83[†]
7	How well are you able to concentrate?	3.50 ± 0.84	3.31 ± 0.69	.335	3.41 ± 0.84	3.34 ± 0.70	.747	3.66 ± 0.83
8	How safe do you feel in your daily life?	3.56 ± 0.84	3.28 ± 0.89	.198	3.66 ± 0.70	3.34 ± 0.55	.051	3.59 ± 0.87
9	How healthy is your physical environment?	3.06 ± 0.88	2.72 ± 0.92	.132	3.06 ± 0.95	2.75 ± 0.92	.185	3.16 ± 0.72
10	Do you have enough energy for everyday life?	3.28 ± 0.77	2.84 ± 1.02	.058	3.31 ± 0.69	3.16 ± 0.88	.434	3.38 ± 0.79
11	Are you able to accept your bodily appearance?	3.72 ± 0.81	3.44 ± 0.88	.188	3.78 ± 0.66	3.44 ± 0.76	.058	3.69 ± 0.59
12	Have you enough money to meet your needs?	3.16 ± 0.68	2.88 ± 1.04	.204	3.28 ± 0.77	3.13 ± 0.79	.428	3.38 ± 0.87
13	How available to you is the information that you need in your day-to-day life?	3.78 ± 0.71	3.56 ± 0.80	.251	3.84 ± 0.63	3.75 ± 0.57	.533	3.78 ± 0.61
14	To what extent do you have the opportunity for leisure activities?	2.94 ± 1.01	3.00 ± 0.84	.789	3.28 ± 0.89	3.09 ± 0.82	.383	3.31 ± 0.86
15	How well are you able to get around?	4.06 ± 0.67	4.03 ± 0.69	.855	4.25 ± 0.57	3.78 ± 0.83	.011*	4.25 ± 0.62
16	How satisfied are you with your sleep?	3.16 ± 0.95	3.16 ± 1.08	1.000	3.25 ± 0.80	3.13 ± 0.75	.523	3.41 ± 0.84
17	How satisfied are you with your ability to perform your daily living activities?	3.75 ± 0.72	3.66 ± 0.65	.587	3.81 ± 0.64	3.63 ± 0.79	.303	3.78 ± 0.61
18	How satisfied are you with your capacity for work?	3.69 ± 0.74	3.63 ± 0.66	.722	3.88 ± 0.66	3.47 ± 0.84	.036*	4.00 ± 0.67
19	How satisfied are you with yourself?	3.63 ± 0.75	3.56 ± 0.72	.734	3.81 ± 0.78	3.41 ± 0.87	.054	3.88 ± 0.75
20	How satisfied are you with your personal relationships?	3.66 ± 0.75	3.50 ± 0.84	.435	3.91 ± 0.59[†]	3.56 ± 0.76	.047*	3.72 ± 0.73
21	How satisfied are you with your sex life?	3.40 ± 0.98	2.84 ± 1.32	.058	3.63 ± 0.66	2.94 ± 1.16	.005*	3.50 ± 0.98
22	How satisfied are you with the support you get from your friends?	3.78 ± 0.49	3.63 ± 0.55	.237	3.78 ± 0.42	3.63 ± 0.75	.310	3.91 ± 0.53
23	How satisfied are you with the conditions of your living place?	3.66 ± 0.70	3.47 ± 0.84	.337	3.63 ± 0.49	3.41 ± 0.76	.176	3.56 ± 0.67
24	How satisfied are you with your access to health services?	3.81 ± 0.54	3.81 ± 0.59	1.000	3.84 ± 0.57	3.56 ± 0.67	.076	3.78 ± 0.55
25	How satisfied are you with your transport?	4.00 ± 0.57	3.66 ± 0.55	.016*	3.91 ± 0.39	3.69 ± 0.54	.373	3.94 ± 0.56
26	How often do you have negative feelings such as blue mood, despair, anxiety, depression? [‡]	2.34 ± 0.70	2.72 ± 0.77	.046*	2.50 ± 0.76	2.56 ± 0.76	.677	2.63 ± 0.91
27	Do you feel respected?	3.47 ± 0.72	3.25 ± 0.84	.268	3.53 ± 0.76	3.25 ± 0.72	.134	3.69 ± 0.69
28	How satisfied are you with your ability to eat foods that you want to eat?	3.88 ± 0.75	3.91 ± 0.73	.867	4.09 ± 0.59	3.81 ± 0.74	.097	4.06 ± 0.62
Pooled score of each domain								
Domain 1	Physical domain score (#3,4,10,15,16,17,18)	14.61 ± 2.27	14.46 ± 2.10	.795	15.11 ± 2.07	14.36 ± 2.09	.152	15.25 ± 2.20
Domain 2	Psychological domain score (#5,6,7,11,19,26)	14.00 ± 2.59	13.06 ± 2.39	.137	13.58 ± 1.89	13.23 ± 2.49	.523	14.62 ± 2.42
Domain 3	Social-related domain score (#20,21,22,27)	14.44 ± 2.05	13.67 ± 2.48	.180	14.84 ± 2.08	13.73 ± 2.41	.052	14.94 ± 2.02
Domain 4	Environmental domain score (#8,9,12,13,14,23,24,25,28)	14.15 ± 1.73	13.46 ± 1.93	.135	14.49 ± 1.64	13.57 ± 1.92	.044*	14.47 ± 2.03

Data are shown as mean ± SD.

* P values < .05, indicated a significant difference between group comparison (experimental vs control group).

† P value < .05, indicated a significant difference within the experimental group (1st score vs 2nd score or 1st score vs 3rd score).

‡ Indicates the higher the score, the lower the satisfaction of patients

§ Higher scores indicate a better quality of life.

¶ Experimental group completed the 2nd examination at 28 days (2nd score) after the treatment, and control group completed the 2nd examination at 14 days (2nd score) after the 1st examination. Experimental group completed the 3rd examination at 90 days (3rd score) after the treatment.

3.2. OHIP-14

On the OHIP-14 scale, higher scores indicated a poorer quality of oral health. There were no significant differences between groups for all items on the OHIP-14 (all $P > .05$) (Table 3). We did find significant improvement in the experimental group in total score on the OHIP-14 28 days after comprehensive periodontal treatment (12.31 ± 8.49 for the initial score vs 10.19 ± 7.86 for the 28 day score; $P < .05$) and 90 days (12.31 ± 8.49 for the initial score vs 10.79 ± 8.59 for the 90 day score; $P < .05$). In addition, the score on 1 item, "Unable to work," showed a significant decrease 28 days after comprehensive periodontal treatment (0.66 ± 0.90 for the initial score vs 0.41 ± 0.56 for the 28 day score; $P < .05$) and 90 days after (0.66 ± 0.90 for the initial score vs 0.50 ± 0.72 for the 90 day score; $P < .05$).

3.3. Multiple linear regression

The results of multiple linear regression for quality of life (scores on the OHIP-14 and WHOQOL-BRIEF) after adjustment for the effects of group, age, and gender showed that: compared with the control group, patients in the experimental group had a negative correlation with the OHIP-14 score ($\beta = -0.91$), suggesting that these patients had a better QoL than did the control group but this did not reach statistical significance; compared with the control group, patients in the experimental group showed a positive correlation with scores on the 4 domains of the WHOQOL-BRIEF scale ($\beta = 0.71, 0.23, 1.08, 0.79$ for the physical, psychological, social-related and environmental domains, respectively), suggesting that patients in that group had better QoL than the control group but this did not reach

Table 3
Scores on the OHIP-14 Taiwan Version in the 2 groups before and after intervention[§].

	Before intervention (1st score)			2nd score [¶]			3rd score [¶]
	Experimental group (N = 32)	Control group (N = 32)	P*	Experimental group (N = 32)	Control group (N = 32)	P*	Experimental group (N = 32)
Total score [§]	12.31 ± 8.49	10.31 ± 8.62	.353	10.19 ± 7.86[†]	10.81 ± 8.96	.768	10.75 ± 8.59[†]
Trouble pronouncing words	0.47 ± 0.72	0.41 ± 0.84	.750	0.56 ± 0.67	0.44 ± 0.84	.513	0.50 ± 0.67
Taste worse	0.59 ± 0.84	0.53 ± 0.84	.767	0.56 ± 0.67	0.56 ± 0.88	1.000	0.59 ± 0.84
Sore jaw	0.78 ± 0.79	0.78 ± 0.87	1.000	0.69 ± 0.82	0.81 ± 1.03	.593	0.63 ± 0.66
Uncomfortable to eat	1.19 ± 1.03	0.78 ± 1.01	.116	1.06 ± 0.91	0.88 ± 0.98	.430	1.09 ± 0.93
Worried by dental problems	1.88 ± 0.98	1.84 ± 1.08	.904	1.53 ± 1.05	1.91 ± 0.86	.122	1.59 ± 0.95
Self-conscious	1.81 ± 0.97	1.81 ± 0.97	1.000	1.66 ± 1.12	1.66 ± 1.07	1.000	1.59 ± 0.84
Avoid eating	1.16 ± 1.17	0.75 ± 1.08	.153	0.94 ± 0.84	0.63 ± 0.79	.131	1.00 ± 0.84
Interrupt meals	0.31 ± 0.54	0.25 ± 0.51	.634	0.25 ± 0.44	0.22 ± 0.42	.7723	0.41 ± 0.56
Concentration affected	0.56 ± 0.76	0.50 ± 0.72	.736	0.38 ± 0.49	0.66 ± 0.75	.080	0.53 ± 0.57
Been embarrassed/social disability	0.97 ± 1.03	0.75 ± 0.92	.373	0.72 ± 0.96	0.66 ± 0.83	.781	0.75 ± 0.88
Irritable with others	0.66 ± 0.90	0.63 ± 0.75	.881	0.50 ± 0.62	0.59 ± 0.76	.590	0.53 ± 0.67
Difficulty doing jobs	0.44 ± 0.76	0.31 ± 0.59	.466	0.31 ± 0.54	0.34 ± 0.60	.827	0.47 ± 0.80
Life unsatisfying	0.84 ± 1.02	0.59 ± 0.98	.321	0.63 ± 0.83	0.81 ± 1.06	.435	0.56 ± 0.91
Unable to work	0.66 ± 0.90	0.38 ± 0.83	.200	0.41 ± 0.56[†]	0.66 ± 1.07	.246	0.50 ± 0.72[†]

Data are shown as mean ± SD.

[§] Higher scores indicate a poorer quality of oral health.

[¶] Experimental group completed the 2nd examination at 28 days (2nd score) after the treatment and control group completed the 2nd examination at 14 days (2nd score) after the 1st examination. Experimental group completed the 3rd examination at 90 days (3rd score) after the treatment.

* P values were derived from between group comparisons (experimental vs control group).

[†] P < .05, indicated a significant difference within the experimental group (1st score vs 2nd score or 1st score vs 3rd score).

statistical significance either. Both age and gender showed no significant correlation with scores on the OHIP-14 and WHOQOL-BRIEF, suggesting that those 2 covariates had no significant effect on the QoL of patients with PD (Table 4).

3.4. Symptoms of PD

The changes in oral conditions after comprehensive periodontal treatment in the experimental group are summarized in Table 5.

Table 4
Multiple linear regression of OHIP_14T and WHOQOL-BREF scores after adjustment for the effects of group, age, and gender.

Outcomes	Covariates	β	P
Total score of OHIP-14T	Experimental group (ref. = control group)	-0.91	.690
	Age, years	0.07	.466
	Gender (ref. = male)	-1.74	.426
WHOQOL-BREF Physical domain	Experimental group (ref. = control group)	0.71	.207
	Age, years	-0.01	.693
	Gender (ref. = male)	0.76	.158
Psychological domain	Experimental group (ref. = control group)	0.23	.690
	Age, years	-0.01	.815
	Gender (ref. = male)	1.07	.06
Social-related domain	Experimental group (ref. = control group)	1.08	.074
	Age, years	-0.02	.535
	Gender (ref. = male)	1.01	.080
Environmental domain	Experimental group (ref. = control group)	0.79	.100
	Age, years	0.01	.971
	Gender (ref. = male)	0.76	.097

Results are shown as estimated β with corresponding P values.
ref. = reference group

There was no change in the number of teeth. The number of teeth with probing depth ≥ 5 mm and the percentage of dental plaque were both significantly reduced after the intervention (both P < .001), suggesting that comprehensive periodontal treatment alleviated the symptoms of PD.

4. Discussion

A plan for comprehensive PD care was implemented in Taiwan over 6 years ago. The present study evaluated the effectiveness of this plan using a quasi-experimental design. Although our experimental results only partially supported our hypothesis, the results of our study supported the use of comprehensive periodontal treatment to improve OHRQoL and to alleviate periodontal symptoms. Multiple researchers including Wong et al,^[28] Shanbhag et al,^[7] and Al-Harathi et al^[8] have found a variable but generally modest improvement in quality of life after treatment for PD. Possible reasons include not asking questions specific enough to oral health as part of the survey or not allowing enough time after the intervention before asking about a positive

Table 5
Changes in oral conditions after treatment in the experimental group (N = 32).

	Before intervention	After intervention	P
Total number of teeth	26.34 ± 3.26	26.31 ± 3.22	0.325
Number of teeth with probing depth ≥ 5 mm	13.91 ± 7.27	4 ± 4.10	<.001
Dental plaques %	80.34 ± 13.67	53.59 ± 24.93	<.001
Decrease of probing depth up to 2 mm in >1 location after treatment* (number of teeth)	ND	12.09 ± 6.88	NA

* Only for those patients with probing depth ≥ 5 mm before treatment.

Data are shown as mean ± SD.

NA = not assessed, ND = not derived.

effect. Patients' conditions may even worsen 1 month after treatment for PD because the patients' teeth may loosen and cause discomfort. Although quality of life data did not uniformly support our hypothesis, the depth of the periodontal pockets and the amount of dental plaque nevertheless improved 1 month after treatment. Chan et al.^[29] also found that patients who received comprehensive periodontal treatment had better clinical outcomes than patients who received conventional periodontal treatment.

On the first follow-up after periodontal treatment, the scores of the experimental group were higher than those of the control group on 5 items on the WHOQOL-BREF scale: "To what extent do you feel your life is meaningful?," "How well are you able to get around?," "How satisfied are you with your capacity for work?," "How satisfied are you with your personal relationships?," and "How satisfied are you with your sex life?," indicating that this plan for comprehensive PD care had beneficial effect on patient's capacity for work, personal relationships and sex life. The scores of the experimental group were higher than those of the control group for the pooled score of items in the "environmental domain." On the 28-item WHOQOL-BREF scale, 9 items are in the environmental domain. These include "How safe do you feel in your daily life?," "To what extent do you have the opportunity for leisure activities?," "How satisfied are you with your ability to eat foods that you want to eat?" indicating that the plan for comprehensive PD care had a beneficial effect on patient's capacity to fit into the environment of daily life.

On "To what extent do you feel your life to be meaningful?" (item #6), the scores of the experimental group were not only higher than those of the control group but also significantly higher than their baseline score (initial score), suggesting that the patients in the experimental group had a more positive attitude toward life after comprehensive periodontal treatment. Similarly, we found a significant increase in the score for "How satisfied are you with your health?" (item #2) in the experimental group after they received comprehensive periodontal treatment 28 and 90 days after that treatment, suggesting that the patients in the experimental group had more positive feeling about their health after the comprehensive periodontal treatment.

The OHIP-14 has long been used to assess the impact of PD on quality of life (QoL) before and after therapy.^[28] Although there were no significant differences between the 2 groups on all items on the OHIP-14, we did find significant improvement in the experimental group in total score on the OHIP-14 28 days and 90 days after comprehensive periodontal treatment. This finding is consistent with previous reports on non-surgical periodontal therapy. Wong et al found that the median OHIP-14S scores gradually fell from 17 at baseline to 14 over the first 6 months and remained at that plateau 12-months posttreatment ($P < .005$) after non-surgical periodontal therapy. Improvements in the sub-domains of physical pain, psychological discomfort and psychological disability accounted for the changes. This study demonstrated that OHQoL improvement was associated with non-surgical periodontal therapy responses.^[28] Goel and Baral^[30] studied the impact of chronic PDs and nonsurgical periodontal therapy on OHRQoL and found that the OHIP-14 total scores for patients with PD s fell from 7 (3–11) to 3 (1–7.5) after nonsurgical periodontal therapy.

There were limitations to this study. Although the sample size had been estimated by a power analysis, it was still relatively small (32 participants for each group). Therefore, the statistical outcome of our study should be validated with a larger

periodontal patient group. Many subjects dropped out of the study during the study period (21.95% in the experimental group and 11.11% in the control group). The follow-up period may have been too short as it may take 3 to 6 months for some patients to notice an improvement. In terms of the quasi-experimental design, the experimental and control groups were not run concurrently in the same dental clinic, so that patients might have had different experiences in different dental clinics in terms of the protocol and quality of periodontal therapy. The results of multiple linear regressions showed no significant correlation between treatment groups and scores on the WHOQOL-BREF and OHIP-14 after adjustment for age, and gender, suggesting that the effect of comprehensive periodontal treatment on the OHRQoL was confounded by age, and gender. Finally, although the data suggested that the comprehensive periodontal treatment alleviated the symptoms of PD, the correlation between severity of PD and OHRQoL was not analyzed in this study.

In conclusion, the plan for comprehensive PD care in Taiwan improved the OHRQoL of patients with PD and alleviated periodontal symptoms. To improve OHRQoL, we recommend maintaining good oral health, having regular oral examinations, assessing symptoms of PD, and receiving comprehensive care and follow-up for PD.

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