



Research article

Psychological problems and their impact on oral mucosal disease patients' quality of life: A cross-sectional study in the Chinese population

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ABSTRACT

Objectives: We aimed to investigate the presence of common psychological factors (i.e., stress, depression, anxiety) and their impact on the Oral health-related quality of life (OHRQoL) in patients diagnosed with four oral mucosal diseases (OMDs): recurrent aphthous ulcers (RAU), oral lichen planus (OLP), oral leukoplakia (OLK), and oral submucous fibrosis (OSF).

Methods: A total of 229 patients with clinically diagnosed OMDs were enrolled in this study, consisting of 55 RAU, 68 OLK, 50 OLP, and 56 OSF patients. The patients were statistically analyzed for psychological problems and OHRQoL using the Visual Analog Scale (VAS), the 5-item Oral Health Impact Profile (OHIP-5) and the Depression Anxiety Stress Scale-21 (DASS-21) scales.

Results: There were 229 valid questionnaires collected, consisting of 83 females and 146 males with a mean age of 45.24 ($SD = 11.88$) years. Multiple regressions between DASS-21 scores and OHIP-5 scores revealed generally negative impacts of psychological problems on OHRQoL, with depression on OLP ($\beta = 0.47$), OLK ($\beta = 0.65$) and OSF ($\beta = 0.38$), stress on RAU ($\beta = 0.29$), OLP ($\beta = 0.72$), OLK ($\beta = 0.38$) and OSF ($\beta = 0.60$), and anxiety on OLP ($\beta = 0.33$), OLK ($\beta = 0.49$) and OSF ($\beta = 0.51$).

Conclusions: Psychological problems like depression, stress, and anxiety were found to be prevalent in OMDs patients and adversely affected their OHRQoL. The results support the bio-psychosocial medical model in the treatment of OMDs patients.

Clinical significance: The present study reinforced the crucial roles of psychological factors in impacting OMDs patients' OHRQoL. Therefore, it is necessary to monitor patients' psychological status and OHRQoL using questionnaires like DASS-21 and OHIP-5. Followed by psychological interventions, the treatment is expected to be enhanced.

1. Introduction

Oral mucosal diseases (OMDs) are a general term for diseases that occur in the oral mucosa and soft tissues. Common OMDs include

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recurrent oral ulcers (RAU), oral lichen planus (OLP), oral leukoplakia (OLK), and oral submucous fibrosis (OSF). They have considerable prevalence and consequences, adversely impact on the Oral health-related quality of life (OHRQoL) for a large proportion of patients. OHRQoL is a widely recognized concept in dental research that embraces the biopsychosocial model of OMDs, covering aspects like oral health, functional well-being, emotional well-being and treatment expectations [1].

In the Global Population, approximately 1/4 currently suffers or has suffered from RAU. Prolonged disease duration, increased pain, and long healing periods adversely impact on eating and speaking [2]. OLP, another common chronic oral mucosal disease, has a population prevalence ranging from 0.5% to 3% [3]. OLP causes pain, roughness, and discomfort with a risk of cancer transformation, listed as a potentially malignant disease by the WHO. OLK has a population prevalence of 2.23%. It is characterized by predominantly white lesions with a transformation rate of about 3% – 5% into cancer [4]. Similarly, OSF was originally only reported in East and Southeast Asia due to frequent betel nut chewing habit, but it is now becoming a worldwide health problem [5]. It is a chronic and potentially malignant disease with a malignant transformation rate of 7% – 13% to oral squamous cell carcinoma (OSCC) [6]. OSF symptoms include a burning sensation, frequent ulcers, whitening and sclerosis of oral mucosa, and restricted mouth opening [7].

OMDs are found to adversely impact on patients' OHRQoL, with an increasing recognition of the role of psychological factors mediating this impact [8–17]. Approximately 30 % of patients in OMDs were found to continue to exhibit psychopathological symptoms that went unrecognized or untreated [18]. Even during remission, OLP patients' psychological issues persisted [19]. On the other hand, although most OMDs are symptomatically treatable, they damage patients' OHRQoL in many aspects, including oral function, appearance, interpersonal relationships and self-image, leading to psychological problems that react on OMDs in return [12, 20, 21]. For example, psychological stress was argued to increase with adverse life events and contribute to the onset of RAS [22, 23]. Also, patients' inadequate knowledge and fear of OMDs may exacerbate adverse psychological states, which may in return aggravate OMDs [24]. Now, there is a growing advocacy to understand the crucial role of psychological factors in the treatment of OMDs as proposed by the biopsychosocial medical model [16, 25–27].

While common psychological problems (e.g., depression, stress and anxiety) are frequently found in OMDs patients, their presence and impact differ across different OMDs. Repeated evidence showed that RAU are associated with stress [22, 23] and anxiety [12, 28, 29], but indirectly with depression [11]. OLP has been well-documented to be related to stress, depression, and anxiety [30–34]. OLK have been consistently reported to be associated with anxiety and depression [35, 36], whereas the presence of stress has yet to be examined. Similarly, OSF is found to be associated with anxiety and depression [37–40], and indirectly with stress [41]. It should be noted that the co-occurrence of depression, stress, and anxiety has been widely documented in clinical studies [42–44]. However, no study has examined the above three psychological problems over patients of different OMDs using a consistent measure. Moreover, only a handful of studies explored the impact of these psychological problems on OMDs patients' OHRQoL [19, 45, 46]. Therefore, this study aimed to investigate the presence of the three psychological problems (i.e., depression, stress and anxiety) in four OMDs patient groups and their impact on patients' OHRQoL using questionnaires of DASS-21 and OHIP-5 throughout.

2. Methods

2.1. Design and sample

A cross-sectional design was employed in the present study. The study was conducted at Stomatology Center, the First Affiliated Hospital between March and August 2023. Ethics approval (HN-LL-LW-2023-050) was obtained from The Medical Research Ethics Committee prior to the commencement of the study. Participants were recruited from patients who came for oral mucosal screening [32–35] on their first visit to the outpatient clinic and were diagnosed with any of the four OMDs considered in the present study. The data was collected using surveys and questionnaires in the paper form, and patients' consent was sought for all of them.

A total of 229 subjects (55 RAU, 68 OLK, 50 OLP, and 56 OSF) were recruited during the study period. The sample size of each OMDs was aimed to be approximately equal and no smaller than those in previous studies [23, 24, 29–31, 47]. The patients were provided with detailed information about the research and given the explanation of the purpose and the significance of the survey by the investigator, and subsequently, they signed a consent indicating their voluntary participation.

2.2. Criteria for inclusion and exclusion

The inclusion criteria for OMDs patients in this study were: outpatients who had their first visit to the Mucosal Diseases Unit of the Stomatology Center during the study period, were 18 years of age or older, and had been diagnosed with OMDs based on clinical findings or biopsy results. Additionally, participants needed to: 1) have normal cognitive functioning and no history of psychiatric disorders such as epilepsy, depression, anxiety, symptoms of neurological disorders caused by other diseases, or disorders of consciousness; 2) be capable of effective communication with the investigators and understanding the questionnaire content.

The exclusion criteria were patients who had taken any anxiolytic and phylogenetic drugs in the previous six months, or those who suffered from systemic diseases. This was to avoid findings arising from the (side) effects of different anxiolytic medications.

2.3. Questionnaires

Survey instruments included a basic sociodemographic questionnaire, a visual analog scale (VAS) [48], a 5-item Oral Health Impact Profile (OHIP-5) [49], and a Depression Anxiety Stress Scale-21 (DASS-21) scale [50]. Basic socio-demographic questionnaires included items of gender, age, ethnicity, place of residence, literacy level, marital status, payment method of healthcare, average

annual household income, number of times of brushing teeth, smoking, betel nut eating or not, and a VAS that assesses disease severity. Pain severity was measured by the patient’s subjective symptom scores, with no pain scored as 0, mild pain (1–3) scored as 1, moderate pain (4–6) scored as 2, and severe pain (7–10) scored as 3. Higher scores indicate greater pain intensity and vice versa.

To assess the OHRQoL of the population with OMDs more efficiently and accurately in clinical studies and epidemiological surveys, the Oral Health Impact Profile (OHIP-5) was used. OHIP-5 measures perceived oral health status and OHRQoL [51]. It consists of only five items, evidenced to enhance efficiency without compromising reliability and validity in comparison with early OHRQoL scales (e. g., OHIP-49 and OHIP-14) [52]. The items of OHIP-5 are scored as follows: “not at all” - 0 points, “very slightly” - 1 point, “moderately” - 2 points, “more severely” - 3 points, and “very severely” - 4 points. The higher the scores, the worse the perceived oral health status and OHRQoL. The shortest version of this instrument is the 5-item OHIP which, as its name implies, consists of 5 questions representing the four suggested dimensions: Oral Function, Orofacial Pain, Orofacial Appearance and Psychosocial Impact [53].

In this study, the Depression Anxiety Stress Scale (DASS-21) was used for the first time in the Oral Mucosal Disease Questionnaire (OMDQ) as the short-form version of the Depression Anxiety Stress Scale [54]. Twenty-one items of DASS-21 measure three negative emotional states: depression, anxiety, and stress. The depression factor consists of 7 items (3, 5, 10, 13, 16, 17, 21), which are associated with pathologically poor mood, low self-esteem, and low levels of positive affect; the anxiety factor consists of 7 items (2, 4, 7, 9, 15, 19, 20), which are associated with somatic and subjective experiences of anxiety arousal. The stress factor consists of 7 items (1, 6, 8, 11, 12, 14, 18), which are associated with tension, worry, and ambivalence [55]. A 4-point Likert scale was used (0 = not at all, 1 = partially, 2 = mostly, 3 = fully), with higher scores indicating more substantial negative emotional experiences. For each subscale, a threshold of 9 marked the absence/presence of depression, and 7 for anxiety and 14 for stress. This scale is shown to be more accurate than traditional surveys using the SCL-90 scale [56].

2.4. Statistical analysis

SPSS 26.0 software was used for data processing and statistical analysis of the data. Measurement data conformed to a normal distribution and were described by mean ± standard deviation, and count data were statistically characterized by frequency and constitutive ratio. OHIP-5 scores were described by median and interquartile range (IQR). DASS-21 scores were interpreted using the criteria defined by Gomez [57], with threshold of 5 for the presence of depression, 4 for anxiety and 8 for stress.

Then, to test the relationships between patients’ OHRQoL and mental health, we first ran Spearman between OHIP-5 scores and DASS-21 scores in four OMDs, and the significance level $\alpha = 0.05$ was used. With the correlations found, we assumed a linear regression relationship between DASS-21 scores and OHIP-5 scores. Separate multiple linear regressions were therefore performed to analyze the effect of each DASS-21 subscale (i.e., depression, stress and anxiety) and sum scores on OHIP-5 scores respectively in four

Table 1
Socio-demographics and clinical characteristics of all patients.

Variables	level	Mean (SD)			
		RAU (N = 55)	OLP (N = 68)	OLK (N = 50)	OSF (N = 56)
Age		43.49 (13.21)	46.10 (11.95)	45.66 (11.83)	45.71 (10.54)
Age group (%)	19–44	27 (49.09)	33 (48.53)	25 (50.00)	25 (44.64)
	45–59	19 (34.55)	26 (38.24)	20 (40.00)	26 (46.43)
	≥60	9 (16.36)	9 (13.24)	5 (10.00)	5 (8.93)
Sex (%)	Male	24 (43.64)	40 (58.82)	30 (60.00)	52 (92.86)
	Female	31 (56.36)	28 (41.18)	20 (40.00)	4 (7.14)
Residence (%)	City	32 (58.18)	47 (69.12)	24 (48.00)	33 (58.93)
	Town	23 (41.82)	21 (30.88)	26 (52.00)	23 (41.07)
Marital status (%)	Unmarried	6 (10.91)	7 (10.29)	11 (22.00)	6 (10.71)
	Married	40 (72.73)	55 (80.88)	35 (70.00)	49 (87.5)
	Divorced	6 (10.91)	4 (5.88)	2 (4.00)	1 (1.79)
	Widowed	3 (5.45)	2 (2.94)	2 (4.00)	0 (0.00)
Academic background (%)	Junior high school	22 (40.00)	30 (44.12)	17 (34.00)	17 (30.36)
	Senior high school	18 (32.73)	19 (27.94)	11 (22.00)	25 (44.64)
	University	15 (27.27)	19 (27.94)	22 (44.00)	14 (25.00)
Medical payment method (%)	Self-financing	14 (25.45)	18 (26.47)	17 (34.00)	22 (39.29)
	Medical insurance	41 (74.55)	50 (73.53)	33 (66.00)	34 (60.71)
Average annual household income(¥)	<60,000	7 (12.73)	18 (26.47)	17 (34.00)	7 (12.5)
	60,000–100,000	35 (63.64)	27 (39.71)	21 (42.00)	27 (48.21)
	>10,000	13 (23.64)	23 (33.82)	12 (24.00)	22 (39.29)
Tobacco habit (%)	No habit	46 (83.64)	50 (73.53)	33 (66.00)	30 (53.57)
	Smoking	9 (16.36)	18 (26.47)	17 (34.00)	26 (46.43)
Areca habit (%)	No habit	43 (78.18)	47 (69.12)	32 (64.00)	6 (10.71)
	Chewing betel nut	12 (21.82)	21 (30.88)	18 (36.00)	50 (89.29)
Brushing frequency (%)	Once/day	13 (23.64)	26 (38.24)	20 (40.00)	15 (26.79)
	Twice/day	36 (65.45)	33 (48.53)	19 (38.00)	36 (64.29)
	Three times/day	6 (10.91)	9 (13.24)	11 (22.00)	5 (8.93)
VAS		1.71 (0.92)	1.29 (0.90)	1.18 (0.77)	0.57 (0.81)

Note: RAU: recurrent aphthous ulcers, OLP: oral lichen planus, OLK: oral leukoplakia, OSF: oral submucous fibrosis.

oral mucosal patient groups, and the significance was determined according to the α level of 0.05. Meanwhile, to prevent confounding bias, we corrected all models for demographics and clinical characteristics, including age, gender, residence, marital status, literacy, education level, mode of healthcare payment, mean annual household income, smoking, betel nut, tooth brushing, and VAS.

3. Results

3.1. Socio-demographic and clinical characteristics

In this study, 229 questionnaires were collected, comprising 83 females and 146 males with an age range of 19–72 years ($M = 45.24$, $SD = 11$). We first conducted a descriptive analysis for demographics and clinic characteristics, including age, gender, place of residence, education, marital status, mode of healthcare payment, mean annual household income, number of tooth brushing, smoking status, and betel nut consumption. In the OLP, OLK, and OSF populations, there were more males than females, whereas there were fewer males than females in the RAU population (see Table 1). Generally in the oral mucosa patient population, there were fewer people with an average household income of less than 60,000 per year, more occasional smokers than non-smokers, and more infrequent betel nut users than non-users in the three categories except OSF. With respect to pain levels of the diseases, as assessed using visual analog scoring (VAS), RAU patients had highest levels of pain, whereas OSF patients had the lowest levels of pain.

3.2. The descriptive of OHIP-5 and DASS-21 scores

The median and IQR of OHIP-5 scores of four OMDs groups were presented in the boxplot Fig. 1. The median score of RAU was 4, slightly lower than those of the other three OMDs groups (5). Also, the 3rd quartile of RAU was 6, smaller than those of the other three OMDs groups (7; 9; 8), while the 1st quartile was the same across all four OMDs. The medians showed generally higher OHRQoL in RAU relative to OLP, OLK and OSF, consistent with the relative severity of the diseases. On the other hand, the quartiles showed normally distributed OHRQoL in OLP, but in the other three OMDs patients had much lower OHRQoL than the median, suggesting some RAU, OLK and OSF patients were more impacted by their OMDs.

The summary plot (Fig. 2) of DASS-21 scores showed the prevalence of the depression, anxiety and stress across four OMDs patient groups. Specifically, anxiety is the most prevented (80.00 %; 67.65 %; 84.00 %; 66.07 %), followed by depression (45.45 %; 58.82 %; 62.00 %; 52.57 %), with stress being the least (29.09 %; 42.65 %; 38.00 %; 28.57 %).

3.3. DASS-21 scores and OHIP-5 scores correlation analysis

Broad correlations between the DASS-21 subscale (i.e., stress, depression, anxiety), the DASS-21 sum and OHIP-5 scores in RAU, OLP, OLK, and OSF groups were observed using Spearman correlation analysis (Table 2). In the RAU group, OHIP-5 was positively correlated with depression ($r_s = 0.330$, $P = 0.014$), stress ($r_s = 0.497$, $P < 0.001$), and DASS-21 ($r_s = 0.309$, $P = 0.022$), but not with anxiety ($r_s = -0.015$, $P = 0.912$). In the OLP group, OHIP-5 was positively correlated with depression ($r_s = 0.398$, $P = 0.001$), stress ($r_s = 0.453$, $P < 0.001$), anxiety ($r_s = 0.376$, $P = 0.002$), and DASS-21 ($r_s = 0.462$, $P < 0.001$). Similarly, in the OLK group, OHIP-5 was positively correlated with depression ($r_s = 0.777$, $P < 0.001$), stress ($r_s = 0.701$, $P < 0.001$), anxiety ($r_s = 0.568$, $P < 0.001$) and the DASS-21 ($r_s = 0.800$, $P < 0.001$) were positively correlated. Again in the OSF group, OHIP-5 was positively correlated with depression ($r_s = 0.569$, $P < 0.001$), stress ($r_s = 0.667$, $P < 0.001$), anxiety ($r_s = 0.489$, $P < 0.001$), and DASS-21 ($r_s = 0.632$, $P < 0.001$).

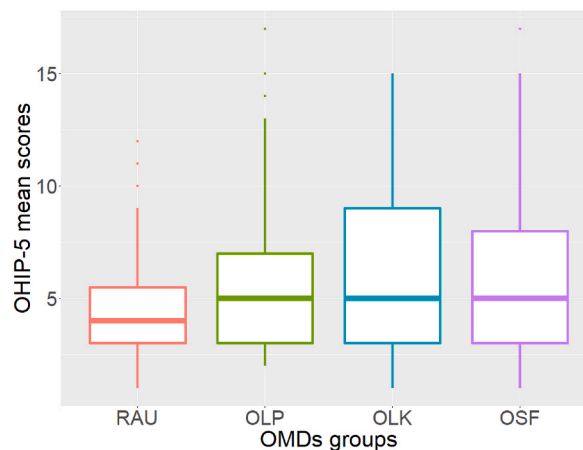


Fig. 1. The boxplot showed the median and IQR of OHIP-5 scores of four OMDs patient groups. RAU: recurrent aphthous ulcers; OLP: oral lichen planus; OLK: oral leukoplakia; OSF: oral submucous fibrosis.

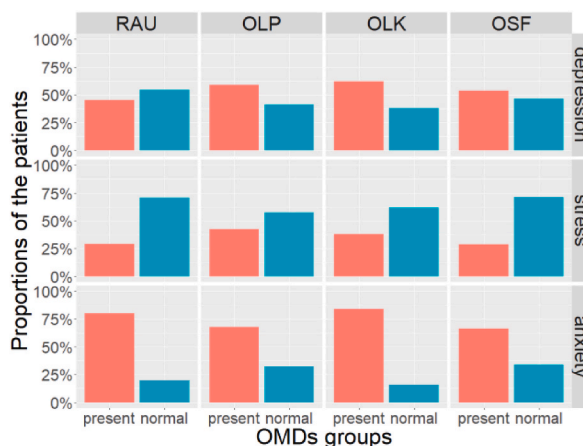


Fig. 2. The presence (in percentage) of the three psychological problems in four OMDs patient groups. RAU: recurrent aphthous ulcers; OLP: oral lichen planus; OLK: oral leukoplakia; OSF: oral submucous fibrosis.

Table 2
The correlations between DASS-21 (subscales and sum) scores and OHIP-5 scores.

Scales		OHIP-5			
		RAU	OLP	OLK	OSF
Depression	r_s	0.330*	0.398***	0.777***	0.569***
Stress	r_s	0.497***	0.453***	0.701***	0.667***
Anxiety	r_s	-0.015	0.376**	0.568***	0.489***
DASS-21	r_s	0.309*	0.462***	0.800***	0.632***

Note: * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$. RAU: recurrent aphthous ulcers, OLP: oral lichen planus, OLK: oral leukoplakia, OSF: oral submucous fibrosis.

Table 3
Multiple linear regressions between DASS-21 (subscales and sum) scores and OHIP-5 scores in four OMDs patient groups.

RAU (recurrent aphthous ulcers)	β	SE	t value	P
DEPRESSION	0.21	0.15	1.43	0.161
STRESS	0.29	0.13	2.25	0.030*
ANXIETY	0.05	0.12	0.43	0.672
DASS21	0.05	0.03	1.77	0.084
OLP (oral lichen planus)				
DEPRESSION	0.47	0.11	4.22	<0.001***
STRESS	0.38	0.08	4.80	<0.001***
ANXIETY	0.33	0.09	3.59	0.001**
DASS21	0.10	0.02	5.59	<0.001***
OLK (oral leukoplakia)				
DEPRESSION	0.65	0.07	9.72	<0.001***
STRESS	0.72	0.09	7.64	<0.001***
ANXIETY	0.49	0.16	3.06	0.004**
DASS-21	0.16	0.02	11.09	<0.001***
OSF (oral submucous fibrosis)				
DEPRESSION	0.38	0.07	5.77	<0.001***
STRESS	0.60	0.14	4.24	<0.001***
ANXIETY	0.51	0.10	5.15	<0.001***
DASS-21	0.10	0.02	6.27	<0.001***

Note: * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$. All models were controlled for age, sex, residency, marital status, literacy level, health care payment method, mean annual household income, smoking, betel nut, tooth brushing and VAS.

3.4. Multiple linear regression analysis

The effect of each DASS-21 subscale (i.e., stressors, anxiety and depression) and DASS-21 sum scores on OHIP-5 scores in four OMD groups was examined using multiple linear regressions with α level of 0.05 (see Table 3). Similar to the results of correlation tests, psychological problems were frequent predictors of OHRQoL. In the RAU population, the results showed that only stress increases with OHIP-5 scores ($\beta = 0.21, P = 0.03$). However, all other three factors were no significant predictors of OHIP-5 (P 's > 0.05). In the OLP population, depression, stress, anxiety and DASS-21 sum scores all increase with OHIP-5 scores ($\beta = 0.47, P < 0.001; \beta = 0.38, P < 0.001; \beta = 0.33, P = 0.001; \beta = 0.10, P = 0.001$). Also, in the OLK population, depression, stress, anxiety and DASS-21 sum scores all increase with OHIP-5 scores ($\beta = 0.67, P < 0.001; \beta = 0.72, P < 0.001; \beta = 0.49, P = 0.004; \beta = 0.16, P = 0.001$). Again in the OSF population, depression, stress, anxiety, and DASS-21 sum scores all increase with OHIP-5 scores ($\beta = 0.38, P < 0.001; \beta = 0.60, P < 0.001; \beta = 0.51, P < 0.001; \beta = 0.10, P = 0.001$).

4. Discussion

This study aimed to investigate the cooccurrence of common psychological problems (i.e., depression, stress and anxiety) in four OMDs patient groups and the impact of these psychological problems on patients' OHRQoL. In the present study, OMDs patients were found to usually suffer from common psychological problems (i.e., depression, stress and anxiety) and they were likely to co-exist. Also, those psychological problems were shown to adversely impact on patients' OHRQoL.

The mean age of our study population was 45.24 ± 11.88 years, higher than that in the previous study [9]. We speculate that it is due to an increase in the number of adult and elderly patients seeking treatment for OMDs as the average life expectancy increases. There were more males than females in the OLP, OLK, and OSF populations, which may be due to the close relationship between the occurrence of OMDs and endocrine hormone levels, dietary habits, nutritional patterns, smoking, alcohol consumption, and the ability to withstand psychological stress between male and female [58]. In contrast, there were fewer males than females in the RAU population, which is consistent with the findings of previous studies [23,59]. More frequent betel quid eaters were found in OSF patients, arguably due to the fact that betel quid eating is a well-documented high-risk factor for OSF [60,61]. Meanwhile, OSF patients were found to have the lowest pain level as measured by VAS among four OMDs. As almost all OSF patients are characterized by the habit of chewing betel nuts, their buccal mucosa gradually develops submucous fibrosis, resulting in reduced sensation of pain [62].

The present study found the presence and impact of stress on the OHRQoL in RAU, in line with the previous studies [16,17,28,29]. The effect of depression was absent, as opposed to the results from Suresh et al. [11,19]. They ran the analysis on the combined subject groups of RAU, OLP and burning mouth syndrome, and therefore the effect may not be present in some subject groups. Instead, the present study provided a direct evidence that depression unlikely impacted upon the OHRQoL in RAU patients. Similarly, the effect of anxiety was not found, as opposed to previous findings [11,28,29], presumably caused by inconsistent psychological feedback from individuals in the survey, so that different groups of research subjects or research methods may even arrive at diametrically opposed conclusions. Also, anxiety and depression in RAU patients were found to increase with RAU severity, so the difference in the results may also due to the different level of severity of RAU patients in the present study [63].

With respect to OLP, we found the presence of depression, stress and anxiety, and their significant impact on patients' OHRQoL. Anxiety and depression have been well examined in the previous studies [15,32–34], and stress was in line with the findings from Valter et al. [18]. The findings from the present study reinforced presence of common psychological problems in OLP patients and their adverse impact on patient's OHRQoL.

OLK patients were found to suffer from all three common psychological problems, i.e., anxiety, depression and stress, that impacted on their OHRQoL. The presence of anxiety and depression is consistent with those from the previous studies [35]. However, studies have rarely examined the effects of stress. This study included the examination of stress and revealed the presence of stress in OLK patients and its negative effect on their OHRQoL.

In OSF, we observed that in addition to well-documented anxiety and depression [35,37–40], stress was also associated with patients' OHRQoL. This observed impact of stress supports the early finding from the study of Al'Absi [64]. Oral burning, limited opening, difficulty in swallowing, and recurrent ulcerations were shown to cause OSF patients to suffer from the above psychological problems, resulting in a reduced OHRQoL [65]. Psychological interventions on common psychological problems should therefore be considered in the treatment of OSF.

The present study was the first to use the DASS-21 questionnaire in the population of oral mucosa patients, demonstrating its utility in revealing the psychological problems (depression, stress and anxiety) and their significant impact on patients' OHRQoL. Statistical surveys have shown that domestic and international scholars, when studying the psychological factors of oral mucosal disease, mostly employed the Anxiety Depression Self-Assessment Scale [66], the Beck Anxiety/Depression Scale [67], the Hamilton Anxiety/Depression Scale [68], etc. All of these targeted anxiety and depression, while other psychological states went overlooked [69]. In the present study, we included the examination of psychological stress to expand this field and provided some reference for future research in the area of psychological.

The psychological problems are thought to exist at all stages of the diagnosis and treatment, and therefore identifying them using psychological questionnaires like DASS-21 and introducing effective interventions are of great significance in improving patients' OHRQoL. This is an area that deserves further research, and we look forward to more scholars to explore and promote it. Healthcare professionals are advised to encourage patients to face up to their illnesses and express their needs better. As a result, patients could cope with their conditions optimistically and build up their confidence in the treatment of their illnesses, and thereby enhancing their recovery and improving their overall quality of life.

The present study has the following limitations: 1) the data produced an estimate of the prevalence of psychological problems in OMDs patients, but was based on the sample from a single center. As one of the national key institutions for the comprehensive prevention and treatment of OMDs, patients come from all over the country, and therefore our sample is adequately representative. However, it is possible that certain kinds of patients tend not to travel for treatment, e.g., those with low socioeconomic background or mild symptoms; 2) we had no control group of the healthy population, lacking the comparison between the healthy group and the patient groups. Having the comparison between healthy and patient groups allows for the more accurate detection of certain psychological problems [40]. Follow-up studies are suggested to use a larger sample involving healthy participants from multiple centers, and further examine the prevalence psychological problems at different stages of diagnosis and treatment of OMDs with comparing them with healthy population.

5. Conclusion

In conclusion, our results showed that common psychological problems, including depression, stress and anxiety, are prevalent in OMDs patients and adversely impact on their OHRQoL. The findings support the advocacy of the biopsychosocial medical model on integrating psychological interventions with conventional treatments to enhance patients' coping mechanisms and improve overall well-being. The utilization of an effective psychological status and quality-of-life questionnaires (e.g., DASS-21 and OHIP-5) are thought to enables healthcare professionals to accurately identify patients' needs, and provide the basis for individualized treatment and precise preventive measures throughout the disease development stages, thereby ultimately improving the OHRQoL for patients. Our statistically grounded findings merit further validations and applications from clinicians of wider context.

Ethical statement

This study was approved by The Medical Research Ethics Committee of the First Affiliated Hospital of the Hunan University of Chinese Medicine with the approval ID: (HN-LL-LW-2023-050).

Data availability statement

The relevant experimental data are made available on Open Science Framework and can be accessed through the following link: https://osf.io/n5zqs/?view_only=230eeeffd34a4c1c831086da1441eb36.

CRediT authorship contribution statement

Yao Ye: Writing – original draft, Methodology, Investigation, Conceptualization. **Jinjin Wu:** Writing – review & editing, Software, Formal analysis. **Yuzhe Dai:** Validation, Resources, Data curation. **Yisi Tan:** Methodology, Formal analysis, Conceptualization. **Yiyang You:** Supervision, Resources, Formal analysis. **Jin Tan:** Writing – review & editing, Project administration, Funding acquisition.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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