Comparison of the Psychological Condition of Chinese Patients with or without Halitosis Complaints

Jing WANG[1,2], Lu HE[1]

Objective: *To investigate the psychological condition of Chinese patients with or without a primary complaint of halitosis.*
Methods: *The psychological condition of 196 Chinese patients who visited the Department of Periodontics was evaluated using the Cornell Medical Index (CMI) health questionnaire. The breath malodour of all patients was scored using the organoleptic test (OLT).*
Results: *More than half of patients (53.1%) complaining of halitosis actually demonstrated pseudo-halitosis. The overall scores and scores for emotional symptoms of CMI were significantly higher in patients with a chief complaint of halitosis than in those without such a complaint ($P < 0.05$). Females with a chief complaint of halitosis exhibited significantly higher scores for all parameters relative to females without a complaint ($P < 0.05$), while males with a chief complaint of halitosis exhibited enhanced emotional symptoms, particularly inadequacy, anxiety, and tension ($P < 0.05$) when compared with males without a halitosis complaint. Among patients complaining of halitosis, CMI scores for all parameters showed no difference between genuine halitosis female patients and pseudo-halitosis female patients, while male patients with pseudo-halitosis showed higher scores in the CMI overall score, scores for emotional symptoms and sensitivity, than males with genuine halitosis.*
Conclusion: *There was a marked inconsistency between the complaints of patients and their actual odour status. Patients with a chief complaint of halitosis exhibited a greater level of inadequacy, depression, anxiety, sensitivity, anger, and stress. The psychological status of the patients varied with gender.*
Key words: *halitosis, malodour, psychological*
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Halitosis is defined as unpleasant smell exhaled from the oral cavity[1,2]. Malodour mainly originates from the oral cavity and only about 10% of the cases are the result of systemic disorders[3]. Halitosis may be classified as genuine halitosis, pseudo-halitosis, or halitophobia[4]. If a patient with a complaint of halitosis has no detectable malodour, he/she is defined as pseudo-halitosis. Tongue coating and periodontal diseases are considered as the main etiology of genuine oral malodour[5-7]. If the patient persists with his/her malodour complaint, even after counselling and treatment, a diagnosis of halitophobia can be assigned[8]. In other words, among patients complaining of halitosis some have actual malodour, whereas others do not have, or have slight bad breath. According to the review by Loesche, only 40% to 60% of individuals with a complaint of bad breath can be diagnosed with genuine halitosis[9].

It has been reported that subjects with a complaint of oral malodour have psychopathological symptoms such as personal sensitivity and obsession[10]. Patients with a lower degree of halitosis exhibit a stronger psychopathological profile that tends toward neurosis[11]. Suzuki also reported that patients with pseudo-halitosis had significantly higher physical, but not emotional,

1 Department of Periodontics, Peking University School and Hospital of Stomatology, National Engineering Laboratory for Digital and Material Technology of Stomatology, Beijing Key Laboratory of Digital Stomatology, Beijing, P.R. China.
2 Department of Periodontics and Oral Medicine, Hangzhou Dental Hospital, Hangzhou, P.R. China.

Corresponding author: Dr Lu HE, Department of Periodontics, Peking University, School and Hospital of Stomatology, 22# Zhongguancun South Avenue, HaiDian District, Beijing 100081, P.R. China. Tel: 86 10 82195368; Fax: 86 10 62173402. Email: helubj@tom.com.

scores than those with genuine halitosis, and were considered provisionally neurotic[12]. In literature published in 2001, Parker et al[13] thought that the Chinese do tend to deny depression or express it somatically. Rayman also reported that the perception of halitosis is different in culturally diverse populations[14]. In the United States, halitosis ranks behind dental caries and periodontal diseases as the leading reason why people visit a dental clinic[5]. However, to date, there has been no investigation of the psychology profile of those who complain of bad breath and ask for help in Chinese dental clinics.

The purpose of this study was to investigate the psychological condition of Chinese patients with or without a chief complaint of halitosis, and to understand gender difference on their psychological status.

Methods

Subjects

This study examined 196 patients (96 males, 100 females) who visited a specialist for halitosis (Dr He) and the graduate student (Dr Wang) at the Department of Periodontics, Peking University School and Hospital of Stomatology, Beijing, China, between February 2010 and October 2011. Of these patients, 113 (61 males, 52 females) subjects with halitosis as the primary complaint were assigned into Group 1. Another 83 (35 males, 48 females), patients with primary complaints of periodontal health, such as bleeding on brushing, tooth mobility, gingival enlargement, but without halitosis, became Group 2. All subjects were Chinese non-smokers between the ages of 17 and 79 years (mean age: 37.9 ± 13.7 years), and none had taken antibiotics for 3 months before entering the study and had a medical history of mental illness or psychological diseases.

All subjects were informed of the details of their participation in this study and provided informed consent. The study protocol was approved by the Ethics Committee of Peking University Health Science Center (IRB000010522-06061).

Organoleptic test

The degree of halitosis in patients was estimated using the organoleptic test (OLT), which was performed between 8:00 am and 10:00 am. Patients were required to refrain from drinking alcohol or ingesting food that would generate odour on the day prior to the test and to avoid using scented cosmetics on the day of the examination. Additionally, patients were asked to refrain from brushing, oral rinsing, chewing gum, eating food, or drinking beverages, for at least 2 h before the test.

A privacy screen with a hole was placed between the patient and the examiner. Patients were instructed to close their mouths for 1 min and then exhale air briefly through the mouth at a distance of about 10 cm from the examiner's nose[15]. Results of the OLT were scored on a scale of 0 to 3: 0 was no odour, 1 was barely noticeable odour, 2 was clearly noticeable malodour, and 3 was strong malodour[11]. One practitioner and one dental assistant, who had been previously trained for the test, conducted the OLT. The two examiners each performed intra- and inter– calibration ($\kappa = 0.71$~0.75), and had their evaluations of scores 1 and 2 confirmed by Halimeter (140 ppb or less was considered normal in the manufacturer's instruction; Interscan Corporation; Simi Valley, CA, USA) ($r = 0.81, 0.85$) prior to this study. A score of 1 was later re-confirmed by both examiners on another day. Patients with a score of 2 or 3 were diagnosed with genuine halitosis, while all other patients were defined as pseudo-halitosis.

Questionnaire

The psychological condition of all patients was evaluated using the Chinese version of Cornell Medical Index (CMI) health questionnaire, which contains 18 parts and a total of 195 questions. The reliability and validity of the questionnaire has been verified. The 18 parts of the CMI questionnaire are as follows:

- (A) Eyes and ears
- (B) Upper respiratory system
- (C) Cardiovascular system
- (D) Digestive tract (D)
- (E) Musculoskeletal system
- (F) skin
- (G) Nervous system
- (H) Genitourinary systems
- (I) Fatigability
- (J) Frequency of illness
- (K) Miscellaneous diseases
- (L) Habits
- (M) Inadequacy
- (N) Depression
- (O) Anxiety
- (P) Sensitivity
- (Q) Anger
- (R) Tension

These questions are answered as 'yes' or 'no' and scored as either 1 or 0, after which the score for each part is calculated and summed as the total score. The scores for

Table 1 Halitosis profile of all subjects (organoleptic test score).

Group	Group 1 (n)				Group 2 (n)			
OLT score	0	1	2	3	0	1	2	3
Male	9 (14.8%)	21 (34.4%)	12 (19.7%)	19 (31.1%)	15 (42.9%)	10 (28.6%)	7 (20.0%)	3 (8.6%)
Female	14 (26.9%)	16 (30.8%)	10 (19.2%)	12 (23.1%)	29 (60.4%)	7 (14.6%)	7 (14.6%)	5 (10.4%)
Total	**23 (20.4%)**	**37 (32.7%)**	**22 (19.5%)**	**31 (27.4%)**	**44 (53.0%)**	**17 (20.5%)**	**14 (16.9%)**	**8 (9.6%)**

Table 2 Comparison of CMI scores (mean ± SD) of subjects between Group 1 and Group 2.

CMI section	Group 1 (n = 113)	Group 2 (n = 83)	*P*
CMI (overall)	25.00 ± 15.77	18.35 ± 11.17	0.0^{01}**
A – L (somatic symptoms)	17.84 ± 10.52	15.12 ± 8.81	0.057
M – R (emotional symptoms)	7.28 ± 6.84	3.35 ± 4.45	0.000**
M (inadequacy)	2.24 ± 2.57	1.13 ± 1.60	0.0^{0}0**
N (depression)	0.64 ± 1.03	0.22 ± 0.61	0.000**
O (anxiety)	0.77 ± 1.06	0.20 ± 0.49	0.0^{00}**
P (sensitivity)	0.95 ± 1.39	0.53 ± 1.00	0.016*
Q (anger)	1.50 ± 1.73	0.83 ± 1.43	0.004**
R (tension)	0.89 ± 1.25	0.41 ± 0.73	0.001**

*$P < 0.05$, **$P < 0.01$

somatic symptoms (parts A to L) and emotional symptoms (parts M to R) are also recorded[16]. During collection of their medical and dental history all subjects were required to answer 'yes' or 'no' after the nurse finished reading each question and the answers were all recorded. Then Drs He and Wang talked about the diagnosis and treatment plan for patients after a complete mouth examination.

Statistical analysis

All calculations were performed using the SPSS 18.0 software (SPSS, Chicago, IL, USA). Student *t*-tests were used to compare CMI scores between Group 1 and Group 2, as well as CMI scores between patients who actually had halitosis and patients without malodour.

Differences with a *P*-value of less than 0.05 (two-tailed) were considered to be significant.

Results

Demographic information and halitosis profile

There was no significant difference in terms of sex distribution between Groups 1 and 2. Patients with a primary complaint of halitosis were significantly younger than patients without this complaint (35.6 ± 13.2 vs 41.1 ± 12.7; *t*-test, $P < 0.05$). Average age of males (Group 1: 36.3 ± 13.9; Group 2: 42.8 ± 15.4; *t*-test, $P > 0.05$) and females (Group 1: 34.9 ± 12.0; Group 2: 39.8 ± 11.7; *t*-test, $P > 0.05$) within the two groups showed no difference.

The accordance rate between self-report and actual halitosis was 46.9% in Group 1 and 73.5% in Group 2. There was no difference in organoleptic test score distribution between males and females from both groups (Table 1).

Table 3 Comparison of CMI scores (mean ± SD) between male and female subjects with or without a primary complaint of halitosis.

CMI section	Male		*P*	Female		*P*
	Group 1 (n = 61)	Group 2 (n = 35)		Group 1 (n = 52)	Group 2 (n = 48)	
CMI (overall)	21.60 ± 13.05	17.43 ± 10.68	0.112	28.99 ± 17.77	19.02 ± 11.58	0.001**
A – L (somatic symptoms)	15.51 ± 8.23	13.97 ± 6.90	0.354	20.58 ± 12.22	15.96 ± 9.96	0.040*
M – R (emotional symptoms)	6.13 ± 5.66	3.17 ± 5.32	0.013*	8.63 ± 7.86	3.48 ± 3.75	0.000**
M (inadequacy)	2.23 ± 2.47	1.20 ± 1.81	0.022*	2.65 ± 2.69	1.08 ± 1.44	0.000**
N (depression)	0.56 ± 0.81	0.23 ± 0.77	0.052	0.73 ± 1.24	0.21 ± 0.46	0.006**
O (anxiety)	0.62 ± 0.86	0.26 ± 0.56	0.013*	0.94 ± 1.24	0.17 ± 0.43	0.000**
P (sensitivity)	0.82 ± 1.34	0.46 ± 1.09	0.176	1.10 ± 1.45	0.58 ± 0.94	0.037*
Q (anger)	1.30 ± 1.62	0.83 ± 1.56	0.172	1.73 ± 1.85	0.83 ± 1.34	0.006**
R (tension)	0.56 ± 0.98	0.17 ± 0.71	0.028*	1.27 ± 1.43	0.58 ± 0.71	0.003**

*$P < 0.05$, **$P < 0.01$.

Psychological profile in Group 1 and Group 2

The overall CMI score for subjects with a chief complaint of halitosis was significantly higher than for subjects without a complaint of halitosis ($P = 0.001$). There were significant differences in emotional symptoms (M to R), inadequacy (M), depression (N), anxiety (O), sensitivity (P), anger (Q), and tension (R) between the two groups. Scores of the above parameters were higher in Group 1. However, no significant difference for scores of somatic symptoms (A to L) was observed between the two groups (Table 2).

After being stratified by gender, female patients in Group 1 had significantly higher scores for all of the parameters than female patients in Group 2 (Table 3). In the male patients, the M to R (emotional symptoms), M (inadequacy), O (anxiety), and R (tension) scores of patients with chief complaint of halitosis were significantly higher than patients without the complaint of halitosis ($P = 0.013$, 0.022, 0.013, and 0.028, respectively).

Comparison of psychological status between subjects with/without actual halitosis

After being stratified by gender within Group 1, no significant difference in each parameter of CMI was found between female patients with pseudo-halitosis and those with genuine halitosis (Table 4). Conversely, the overall CMI score for male patients with pseudo-halitosis was significantly higher than that of male patients with genuine halitosis. Significant differences were also found for A to L (somatic symptoms), M to R (emotional symptoms), and P (sensitivity) scores ($P = 0.012$, 0.020, 0.017, and 0.001, respectively).

There was no difference of CMI scores of all parameters between patients with malodour and patients without malodour in Group 2 (Table 5).

For those patients who actually had malodour, scores of M to R (emotional symptoms), M (inadequacy), O (anxiety) were significantly higher in Group 1 than Group 2 (Table 6).

Discussion

Currently, although it is relatively subjective, the organoleptic test is considered to be the gold standard for the diagnosis of halitosis[17]. The two examiners performing the organoleptic test had been trained rigorously according to the previous report[18] and confirmed good correlation with VSC value of Halimeter prior to this study. Therefore, we take the organoleptic test as a rapid, acceptable method for detecting patients' odour status on their first visit. Portable volatile sulfide monitor as auxiliary equipment was usually used on a follow-up visit, if necessary, especially for pseudo-halitosis patients to prove they have no malodour.

Table 4 Comparison of CMI scores (mean ± SD) between genuine halitosis and pseudo-halitosis subjects in Group 1 stratified by gender.

CMI section	Male		*P*	Female		*P*
	Pseudo-halitosis (n = 30)	Genuine halitosis (n = 31)		Pseudo-halitosis (n = 30)	Genuine halitosis (n = 22)	
CMI (overall)	25.80 ± 13.67	17.52 ± 11.18	0.012*	28.40 ± 20.23	29.78 ± 14.16	0.786
A–L (somatic symptoms)	17.97 ± 8.62	13.13 ± 7.19	0.020*	20.27 ± 13.55	21.00 ± 10.43	0.833
M – R (emotional symptoms)	7.87 ± 6.15	4.45 ± 4.64	0.017*	8.30 ± 8.66	9.09 ± 6.77	0.724
M (inadequacy)	2.60 ± 2.69	1.87 ± 2.23	0.253	2.47 ± 2.76	2.91 ± 2.62	0.563
N (depression)	0.73 ± 0.91	0.39 ± 0.67	0.096	0.70 ± 1.26	0.77 ± 1.23	0.837
O (anxiety)	0.80 ± 0.96	0.45 ± 0.72	0.116	0.93 ± 1.39	0.95 ± 1.05	0.952
P (sensitivity)	1.40 ± 1.61	0.26 ± 0.63	0.001**	1.23 ± 1.61	0.91 ± 1.19	0.430
Q (anger)	1.67 ± 1.83	0.94 ± 1.31	0.079	1.43 ± 1.92	2.14 ± 1.70	0.178
R (tension)	0.63 ± 1.00	0.48 ± 0.96	0.554	1.40 ± 1.50	1.09 ± 1.34	0.447

*$P < 0.05$, **$P < 0.01$.

Table 5 Comparison of CMI scores (mean ± SD) between patients with halitosis and patients without halitosis in Group 2.

CMI section	With halitosis (n = 22)	Without halitosis (n = 61)	*P*
CMI (overall)	19.36 ± 12.59	17.98 ± 10.70	0.622
A – L (somatic symptoms)	16.18 ± 9.04	14.74 ± 8.77	0.657
M – R (emotional symptoms)	2.95 ± 5.39	3.49 ± 4.10	0.630
M (inadequacy)	0.95 ± 1.81	1.20 ± 1.53	0.546
N (depression)	0.27 ± 0.88	0.20 ± 0.48	0.617
O (anxiety)	0.14 ± 0.35	0.23 ± 0.53	0.446
P (sensitivity)	0.32 ± 0.57	0.61 ± 1.11	0.128
Q (anger)	0.77 ± 1.72	0.85 ± 1.33	0.824
R (tension)	0.50 ± 1.01	0.38 ± 0.61	0.503

Table 6 Comparison of CMI scores (mean ± SD) of patients who actually had halitosis between Group 1 and Group 2.

CMI section	Group 1 (n = 53)	Group 2 (n = 22)	*P*
CMI (overall)	22.60 ± 13.79	19.36 ± 12.59	0.346
A – L (somatic symptoms)	16.40 ± 9.44	16.18 ± 9.04	0.928
M – R (emotional symptoms)	6.38 ± 6.02	2.95 ± 5.39	0.024*
M (inadequacy)	2.30 ± 2.43	0.95 ± 1.81	0.011*
N (depression)	0.55 ± 0.95	0.27 ± 0.88	0.250
O (anxiety)	0.66 ± 0.90	0.14 ± 0.35	0.001**
P (sensitivity)	0.53 ± 0.95	0.32 ± 0.57	0.243
Q (anger)	1.43 ± 1.59	0.77 ± 1.72	0.113
R (tension)	0.74 ± 1.62	0.50 ± 1.01	0.410

*$P < 0.05$, **$P < 0.01$.

Previous reports of the rate of genuine halitosis in patients complaining of bad breath are extremely varied. Oho et al reported that more than 50% of patients complaining of halitosis exhibited no malodour or only mild malodour[19], though other studies have found rates of pseudo-halitosis (nearly 10% to 30%) that did not correspond with the present finding[12,20-23]. By 1997, there was almost no pseudo-halitosis patient[24], the rate of pseudo-halitosis increased to 7.6% at 2005[25], and in 2009 this number reached 15.7% according to Quirynen's research[21]. This indicated that as time went by, the rate of pseudo-halitosis increased gradually with the increasing of subjects examined. Another possible explanation may be progress in the recognition of halitosis. Moreover, previous studies were performed in different countries or among different populations, and socio-economic status may affect the mental status of subjects[26,27].

The Cornell Medical Index health questionnaire has been used to evaluate the psychosomatic aspects of halitosis patients in Japan and is considered to facilitate the diagnosis of patients who complain of halitosis[11]. Although it is old, the questionnaire has been proved to be of value as a measure of emotional ill health or general overall health among the general population, but of little value as an indicator of specific disorders or general somatic health[16]. Therefore, we did not discuss the results on A to L scores (somatic symptoms). We chose this questionnaire as a simple, easily acceptable instrument during collection of medical history face to face, since it includes questions not only related somatic symptoms, but also psychological conditions. Understanding more psychological profiles of the patients by the questionnaire will benefit us to help patients accordingly during the consultation.

Our findings show that overall CMI score and each CMI parameter measuring emotional symptoms were significantly higher in patients with a chief complaint of halitosis than in patients with no such complaint. Even after being stratified by gender, similar differences were found in female and male subjects. This indicates that we should pay more attention to the psychological condition of patients complaining halitosis, regardless of whether or not they have genuine halitosis.

After being stratified by gender in Group 1, there was no significant difference for females in overall CMI, M to R (emotional symptoms) and each item between pseudo- and genuine halitosis patients. Such phenomenon needs to be highlighted by clinicians. This suggests that whether female patients with a chief complaint of halitosis actually had malodour or not, their psychological status was worse than male patients without a halitosis complaint. A previous study found that two-thirds of halitophobia patients are female, which may indicate that females may be more susceptible to psychological problems[21]. Male pseudo-halitosis patients may be more sensitive than genuine male halitosis patients, indicating clinicians take notice of their words and behaviour when treating these patients. This may be due to the fact that pseudo-halitosis patients are not aware of their own halitosis. When they contact other people, the more sensitive patients are easily

influenced by the gestures or facial expressions of others. These people may believe that they have malodour and others are keeping away from them because of it. Or they may have "imagined halitosis" because of difficulties they ever experienced in their social life[28]. Multiple approaches should be given to confirm them that they do have no malodour. For example, not only an organoleptic test for air samples from breath odour, nasal breath odour, saliva and tongue coating are conducted, but also a portable volatile sulfur monitor is used[29-31]. Such tests may be repeated on different dates.

The CMI overall score and values of each item related to emotion between patients with or without actual halitosis in Group 2 showed no statistical difference in the present study. Patients with actual malodour in Group 1 were more anxious and inadequate than those with halitosis in Group 2, while the latter patients were not aware of malodour. Even if they actually had malodour, their psychological condition was the same as those without halitosis in Group 2. It may be patients' self-consciousness, but not malodour itself, that affects patients' psychological condition. We supposed that patients in Group 1 are unable to find a way to get their malodour treated. In their daily life, they may suffer from discrimination or have trouble with social communication. Over time, their mental burden may increase. In most cases, genuine halitosis has an oral origin[5-7]. It is easily resolved with adequate treatment, including proper oral hygiene instructions, tongue scraping and interdental cleaning, as well as professional periodontal therapy if necessary, extraction of impacted wisdom teeth, restoration of teeth with caries, and even adopting lifestyle suggestions, such as avoiding certain foods or habits[5,27].

This study indicates that when patients with a chief complaint of halitosis are treated, especially in a periodontal clinic, the practitioner should pay more attention to their psychological status, especially for those with pseudo-halitosis. Detailed explanation of halitosis, the reasons for its occurrence, and adequate treatment or suggestions for possible multidisciplinary treatment should be provided. Individual information concerning halitosis and repeated examinations for halitosis should be offered, along with counselling and assurance that "imaginary halitosis" does not exist. If necessary, patients should be referred to a psychologist.

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Conflicts of interest

The authors reported no conflicts of interest related to this study.

Author contribution

Dr Jing WANG performed the study, collected data and prepared the manuscript; Dr Lu HE designed, supervised the study and approved the manuscript.

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