Challenge in the diagnosis, evaluation, and management of burning mouth sensation

A retrospective cohort study

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ABSTRACT

Background. Burning mouth sensation is a common symptom with varying etiologies that can affect patient quality of life. The authors aimed to investigate the clinical characteristics, differentiate the underlying causes, and evaluate the impact on quality of life of patients with burning mouth sensation.

Case Description. A retrospective cohort study of 583 patients with burning mouth sensation symptoms was conducted. Demographic features, clinical characteristics, and associated systemic comorbidities of patients were collected. The 14-item Oral Health Impact Profile Questionnaire score and posttreatment follow-up were evaluated and analyzed among patients. In total, 583 patients with burning mouth sensation symptoms were enrolled; perimenopausal women were most affected; mean (SD) age was 57.04 (12.03) years, and the female to male ratio was 7:1. Patients were stratified into 178 patients (30.53%) with burning mouth syndrome (BMS) and 405 patients (69.47%) without BMS. No significant differences were found for age, sex, clinical characteristics, and 14-item Oral Health Impact Profile Questionnaire scores between BMS and no BMS groups. Notably, 72 of 119 patients without BMS who participated in follow-up had received referrals and treatment for systemic diseases, of which 76.39% achieved complete (45.83%) or partial (30.56%) remission. Among these patients, treatment for gastrointestinal disorders (92.59%), oral candidiasis (78.57%), thyroid diseases (66.67%), and avoidance of local irritants (62.50%) were most effective, and they were perpetuated as the common underlying causes.

Practical Implications. The study results implied significance of adopting multidisciplinary management of burning mouth sensation. It is imperative for dentists and physicians to strengthen their collaborative relationships and focus on both systemic and oral conditions in these patients.

Key Words. Burning mouth sensation; burning mouth syndrome; diagnosis; life quality.

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Burning mouth sensation is a common and subjective symptom in dental clinics that affects patient quality of life (QoL).[1-3] It has been estimated that the prevalence of patients with symptoms of burning mouth sensation is 3.75% through 10.8% of the general population.[3,4] Although this condition occurs frequently, diagnosis and evaluation of burning mouth sensation present challenges for clinicians, reflected mainly in delayed diagnosis, misdiagnosis, and prolonged treatment.[5,6] Burning mouth sensation inevitably has a negative impact, resulting in long-term sick leave, poor QoL, high health care costs, and a high health care burden on society.[7,8]

Patients often describe burning mouth sensation as a "hot," "burning," or "scalded" mouth. Theoretically, burning sensation is a type of pain that is distinct from dull, stabbing, or aching pain. Although it is usually caused by local irritants or sensory neuropathy,[4,9] there are other potential causes of burning mouth sensation, mainly including oral mucosal diseases (such as oral candidiasis and oral lichen planus), oral manifestations of systemic diseases (such as diabetes, anemia, and gastroesophageal reflux disease), parafunctional habits, and adverse reaction to drugs.[10,11] Therefore, the causes of burning mouth sensation are rather complex, and patients with this symptom may

have 1 or more comorbidities, which adds to the difficulty of both diagnosis and management of this condition.[1,5,12]

Burning mouth syndrome (BMS) is 1 of the causes of burning mouth sensation and is frequently considered as the provisional diagnosis of dentists and physicians.[5,7,12] The International Association for the Study of Pain described BMS as a chronic burning mouth sensation with no identifiable cause in the absence of either local or systemic condition or disease.[13] Results of a previous systematic review found that the prevalence of BMS in clinical patients varied from 1.01% through 15.71% worldwide on the basis of racial difference, different diagnostic criteria, and even overdiagnosis of BMS.[14] Investigators with another clinical study from Jordan reported that only 2.3% of patients with a burning mouth sensation were eventually diagnosed with BMS.[15] Despite this, BMS was often the provisional diagnosis for patients with burning mouth sensation; the prevalence of true or primary BMS is worth reevaluating.

Although many researchers have focused on BMS, only a few have assessed the clinical and laboratory aspects of patients with nonspecific burning mouth sensation, and knowledge about this condition remains inadequate.[3,4] The aim of our retrospective cohort study was to identify the demographic characteristics, clinical features, associated systemic comorbidities, impact on QoL, and treatment feedback in Chinese patients with burning mouth sensation and to provide recommendations for diagnosis and management strategy for this complex and multifactorial condition.

METHODS

Study design

Our retrospective cohort study was carried out at Peking University School and Hospital of Stomatology. The Ethics Committee of Peking University Health Science Center reviewed and approved the study protocol (PKUSSIRB-202059167). All patients involved in this study provided their informed consent.

Study populations

Clinical data were collected by means of reviewing the electronic medical records of patients who were seen for an initial consultation in the Department of Oral Medicine. Patients with burning mouth sensation from January 2021 through June 2021 were included in this study. The study inclusion criteria were a chief symptom of burning mouth sensation and patient 18 years or older. Exclusion criteria were patients who could not be reached and patients who had difficulty with communication or refused clinical follow-up.

Measures and data recorded

Demographic features, clinical characteristics, medical history, laboratory testing, and follow-up information for patients with burning mouth sensation were recorded. Demographic features included sex, age, smoking habit, alcohol consumption, oral parafunctional activity, and comorbidities. Clinical characteristics of burning mouth sensation (for example, location, duration, oral mucosa examination findings, local traumatic factors, and severity based on visual analog scale [VAS]) and laboratory data (that is, fungal culture, complete blood count, serum iron, serum folate and vitamin B_{12}, liver and kidney function, blood glucose, thyroid function examination, and immunologic test) were collected and analyzed. The final diagnosis of having BMS or not having BMS was established by means of a 3-step approach in the follow-up clinic, including presumptive diagnosis, testing and diagnostic treatment (such as elimination of irritants), and definitive diagnosis. The diagnostic criteria for BMS applied in this study were from the International Association for the Study of Pain published in 2016 and the International Classification of Orofacial Pain published in 2020.[16,17]

QoL evaluation

The impact on QoL was evaluated by means of questionnaires, with informed consent of the patients. The 14-item Oral Health Impact Profile (OHIP-14) questionnaire was used to assess the impact of burning mouth sensation on QoL of patients experiencing this symptom.[18,19] We followed the guideline of translation, adaptation, and validation of instruments in cross-cultural health

ABBREVIATION KEY

BMS: Burning mouth syndrome.
OHIP-14: 14-item Oral Health Impact Profile.
QoL: Quality of Life.

care research and translated the OHIP-14 questionnaire into Mandarin.[20] The OHIP-14 questionnaire consists of the following 7 dimensions: functional limitation, physical pain, psychological discomfort, physical disability, psychological disability, social disability, and handicaps. Each section consists of 2 questions, which were scored using a 5-point Likert scale. Answers were assigned a value as follows: 0 = never, 1 = hardly ever, 2 = occasionally, 3 = fairly often, and 4 = very often (total scores ranged from 0-56).[21]

Statistical analysis

The demographic and clinical characteristics of patients with burning mouth sensation symptoms were analyzed using the descriptive statistics method. Numerical variables are reported as mean (SD) and range, and categorical variables are reported as frequency and percentage. Dummy variables were used for site symptoms, xerostomia, and altered taste in the analyses. The χ^2 test was used to verify differences between groups. Simple addition and categorical counting were used to score patients' answers on the OHIP-14 questionnaire. The higher the total score, the worse the oral health–related QoL.[22] The correlation analysis used simple linear regression between clinical characteristics and patients' scores on the OHIP-14 questionnaire. The explanatory power of the regression model is represented by an R^2 value. The Durbin-Watson statistic was used to calculate the independence of the residual; a value close to 2 suggests the assumption of independence is reliable. Multicollinearity was assessed by means of variance inflation factor; a variance inflation factor greater than 5 is considered high multicollinearity.

Statistical analyses were performed using SPSS software, Version 26.0 (IBM). Level of significance was set at .05.

RESULTS

Demographic characteristics and review of symptoms

The study population consisted of 583 patients (510 women [87.50%] and 73 men [12.50%]), and the ratio of female to male patients was 7:1. The demographic and clinical characteristics of patients are provided in Table 1. Mean (SD) age of the patients was 57.04 (12.03) years. There were 23 men (12.92%) and 155 women (87.08%) in the BMS group, and the mean (SD) age was 53.86 (12.55) years. The no BMS group consisted of 50 men (12.35%) and 355 women (87.65%), and the mean (SD) age was 58.43 (11.53) years. No significant differences in age, sex, and sleep disorders were found between the BMS group and no BMS group ($P = .06$, $\chi^2 = 0.04$; $P = .85$, $\chi^2 = 0.58$; $P = .45$). Four hundred and five patients (69.47%) had systemic diseases. Among these systemic diseases, gastrointestinal disease, including acid reflux symptoms; gastroesophageal reflux; chronic gastritis; irritable bowel syndrome; and reflux pharyngitis, accounted for a relatively high proportion (55.06%) of the patients in the no BMS group. Approximately one-half of the patients (45.63%) had some degree of sleep disorders. Only 4.12% of patients had local traumatic factors in the oral cavity, and 1.37% had smoking habits.

Clinical characteristics

Eventually, 30.53% of patients received a diagnosis of BMS, and 69.47% of patients received a non-BMS diagnosis (such as oral mucosal diseases, atypical orofacial pain, or temporomandibular joint disorders). Among the accompanying symptoms, xerostomia and altered taste (for example, metallic taste, bitter taste, or hypogeusia) occurred in 48.71% and 22.98% of patients, respectively. All of the oral mucosae could be involved as the site of burning mouth sensation; the dorsum of the tongue was most affected, followed by the lateral border of the tongue, all of the mouth, palate, tip of tongue, buccal mucosa, lip mucosa, posterior aspect of the tongue, gingiva, ventral surface of the tongue, and pharyngeal mucosa. The clinical characteristics of all of the patients with BMS are presented in Table 2. The χ^2 test was used for correlation analysis between patients with BMS and without BMS. There were no significant differences in location of symptoms, altered taste, and xerostomia between the BMS and no BMS group ($\chi^2 = 9.43$, $P = .49$; $\chi^2 = 2.30$, $P = .13$; $\chi^2 = 0.05$, $P = .82$, respectively). Oral candidiasis was the most common oral mucosal lesion in patients without BMS (25.19%), followed by oral lichen planus (12.10%) and fissured tongue (4.94%).

Table 1. Demographic characteristics and review of symptoms of patients with burning mouth sensation.

CHARACTERISTIC	BURNING MOUTH SYNDROME	NO BURNING MOUTH SYNDROME*	TOTAL
Cases, No. (%)	178 (30.53)	405 (69.47)	583 (100)
Sex, No. (%)			
Male	23 (12.92)	50 (12.35)	73 (12.52)
Female	155 (87.08)	355 (87.65)	510 (87.48)
Age, Y			
Mean (SD)	53.86 (12.55)	58.43 (11.53)	57.04 (12.03)
<50, no. (%)	58 (32.58)	83 (20.49)	141 (24.19)
≥ 50, no. (%)	120 (67.42)	322 (79.51)	442 (75.81)
Smoking, No. (%)			
Yes	1 (0.56)	7 (1.73)	8 (1.37)
No	177 (99.44)	398 (98.27)	575 (98.63)
Alcohol Consumption, No. (%)			
Yes	3 (1.69)	7 (1.37)	10 (1.72)
No	175 (98.31)	398 (98.27)	573 (98.28)
Sleep Disorders, No. (%)			
Yes	77 (43.26)	189 (46.67)	266 (45.63)
No	101 (56.74)	216 (53.33)	317 (54.37)
Local Traumatic Factors,† No. (%)			
Yes	NA‡	24 (4.12)	24 (4.12)
No	178	381 (95.88)	559 (95.88)
Removal of Denture, No. (%)			
Yes	2 (1.12)	16 (3.85)	18 (3.09)
No	176 (98.88)	389 (96.15)	565 (96.91)
Underlying Disease, No. (%)			
Digestive system disease	NA	223 (55.06)	223 (38.25)
Acid reflux symptoms§	NA	125 (30.86)	125 (23.23)
Gastroesophageal reflux disease¶	NA	46 (11.36)	46 (7.89)
Chronic gastritis	NA	44 (10.86)	44 (7.55)
Irritable bowel syndrome	NA	5 (1.23)	5 (0.86)
Reflux pharyngitis	NA	3 (0.74)	3 (0.51)
Hypertension#	13 (7.30)	79 (19.51)	92 (15.78)
Diabetes	NA	52 (12.84)	52 (8.92)
Hyperlipidemia	11 (6.18)	19 (4.69)	30 (5.15)
Hypothyroidism	NA	17 (4.10)	17 (2.92)
Autoimmune disease**	NA	13 (3.21)	13 (2.23)
Anemia	NA	7 (1.73)	7 (1.20)
Chronic pharyngitis	NA	5 (1.23)	5 (0.86)
Temporomandibular joint disorder	NA	3 (0.74)	3 (0.51)
Hyperthyroidism	NA	2 (0.49)	2 (0.34)
Salivary gland diseases	NA	1 (0.25)	1 (0.17)

* Including secondary burning mouth syndrome, other mucosal diseases, and other orofacial pain. † Including oral parafunctional activity, sharp residual root or crown of teeth, and biting tongue. ‡ NA: Not applicable. § Patients who reported a range of symptoms, including heartburn, regular acid reflux, acid regurgitation, and abdominal or substernal pain, and did not receive a definitive diagnosis in the gastroenterology department. ¶ Patients who received a diagnosis of gastroesophageal reflux disease in the gastroenterology department. # All patients with hypertension were not taking angiotensin-converting enzyme inhibitors. ** Including rheumatoid arthritis and abnormal immunologic findings in serum.

Table 2. Clinical characteristics of patients with burning mouth sensation symptoms.

CHARACTERISTIC	BURNING MOUTH SYNDROME	NO BURNING MOUTH SYNDROME*	TOTAL
Cases, No. (%)	178 (30.53)	405 (69.47)	583 (100)
Main Symptom			
Burning mouth sensation, no.	178	405	583
Altered taste,† no. (%)	48 (26.97)	86 (21.23)	134 (22.98)
Xerostomia, no. (%)	88 (49.44)	196 (48.40)	284 (48.71)
History of Symptoms, No. (%)			
<3 mo	NA‡	50 (12.35)	50 (8.58)
3 mo or longer	178 (100)	355 (87.65)	533 (91.42)
Location of Symptoms, No. (%)			
Dorsum of tongue	60 (33.71)	171 (42.22)	231 (39.62)
Lateral border of the tongue	30 (16.85)	62 (15.31)	92 (15.78)
All mouth	34 (19.10)	55 (13.58)	89 (15.27)
Palate	19 (10.67)	55 (13.58)	74 (12.69)
Tip of the tongue	27 (15.17)	46 (11.36)	73 (12.52)
Buccal mucosa	10 (5.62)	29 (7.16)	39 (6.69)
Lip mucosa	11 (6.18)	27 (6.67)	38 (6.52)
Posterior aspect of the tongue	12 (6.74)	26 (6.42)	38 (6.52)
Gingiva	10 (5.62)	21 (5.19)	31 (5.32)
Ventral surface of the tongue	6 (3.37)	8 (1.98)	14 (2.40)
Pharyngeal mucosa	2 (1.12)	2 (0.49)	4 (0.69)
Oral Mucosal Findings, No. (%)			
Oral candidiasis	NA	102 (25.19)	102 (17.50)
Lichen planus	NA	49 (12.10)	49 (8.40)
Fissured tongue	NA	20 (4.94)	20 (3.43)
Recurrent aphthous ulcer	NA	19 (4.69)	19 (3.26)
Geographic tongue	NA	16 (3.95)	16 (2.74)
Contact allergic stomatitis	NA	3 (0.74)	3 (0.51)
Lichenoid lesions	NA	3 (0.74)	3 (0.51)
Papillitis of the tongue	NA	3 (0.74)	3 (0.51)

* Including secondary burning mouth syndrome, other mucosal diseases, and other orofacial pain. † Including bitter, metallic taste, and hypogeusia. ‡ NA: Not applicable.

Oral health–related QoL in patients with burning mouth sensation symptoms

Overall mean (SD) OHIP-14 score was 18.40 (6.70); the mean (SD) score was 17.04 (5.82) in patients with BMS and 18.82 (6.93) in patients without BMS. No significant difference was found between the groups ($P = .28$). Among the 7 dimensions of OHIP-14, the physical pain dimension, "painful aching in the mouth" (item 3) score was the highest (mean [SD], 3.33 [0.97]), followed by the psychological discomfort dimension, "been self-conscious" (item 5) score (mean [SD], 3.09 [0.93]), the handicaps dimension, "felt life is less satisfying" (item 13) score (mean [SD], 2.30 [0.98]), and the physiological disability dimension "difficult to relax" (item 9) score (mean [SD], 2.18 [1.04]) (Table 3).[19]

Relationships between clinical characteristics and OHIP-14 scores

The results of our simple linear regression analysis are provided in Table 4. Among the clinical characteristics, VAS (β, 0.30; $P = .00$) was significantly associated with OHIP-14 score.

Table 3. Mean (SD) scores on 14-item Oral Health Impact Profile in patients with burning mouth sensation symptoms (n = 101).

DIMENSION AND ITEM	MEAN (SD)
Total	18.40 (6.70)
Functional Limitation	
Trouble pronouncing words	0.52 (0.89)
Sense of taste worse	0.25 (0.75)
Physical Pain	
Painful aching in the mouth	3.33 (0.97)
Uncomfortable to eat foods	0.51 (1.02)
Psychological Discomfort	
Been self-conscious	3.09 (0.93)
Felt tense	1.88 (0.91)
Physical Disability	
Diet has been unsatisfactory	0.56 (0.93)
Had to interrupt meals	0.17 (0.45)
Psychological Disability	
Difficult to relax	2.18 (1.04)
Been embarrassed	1.79 (1.00)
Social Disability	
Been irritable with others	1.42 (1.07)
Difficulty doing usual jobs	0.25 (0.54)
Handicaps	
Felt life is less satisfying	2.30 (0.98)
Totally unable to function	0.16 (0.42)

Table 4. Relationships between clinical characteristics in patients with burning mouth sensation symptoms and 14-item Oral Health Impact Profile score (n = 101).

VARIABLE	14-ITEM ORAL HEALTH IMPACT PROFILE					
	B*	SE	β	*t*	*P* value†	R^2
Duration of Symptoms	0.07	0.04	0.20	1.93	.06	0.04
Visual Analog Scale‡	1.34	0.44	0.30	3.07	.00	0.09
Altered Taste§	2.00	1.45	0.14	1.38	.17	0.02
Xerostomia¶	–0.48	1.36	–0.04	–0.35	.72	0.00
Location of Symptoms						
Tongue only	–2.85	1.41	–0.20	–2.02	.05	0.04
Tongue with other sites	3.19	1.65	0.19	1.93	.06	0.04
Other sites except tongue	1.06	2.07	0.05	0.51	.61	0.00

* Regression coefficient. † Significance was set at .05. ‡ Degree of burning mouth sensation was evaluated via visual analog scale (0-10). § Including bitter, metallic taste, and hypogeusia; 0 = yes; 1 = no. ¶ 0 = yes; 1 = no.

Associations between duration of symptom (β, 0.20; $P = .06$), altered taste (β, 0.14; $P = .17$, xerostomia (β, –0.04; $P = .72$), location (tongue only: β, –0.20; $P = .05$; tongue with other sites: β, 0.19; $P = .06$, other sites except tongue: β, 0.05; $P = .61$), and OHIP-14 score were not statistically significant.

Table 5. Treatment and effectiveness of patients with no burning mouth syndrome (n = 119).

PROGNOSIS	STABLE CONDITION*	AGGRAVATION†	PARTIAL REMISSION‡	COMPLETE REMISSION§	TOTAL
Cases, No.	43	3	31	42	119
Nondrug Treatment,¶ No. (%)	27 (62.79)	2 (66.67)	9 (29.03)	9 (21.43)	47 (39.50)
Treatments, No. (%)					
Antifungal	2 (4.65)	1 (33.33)	5 (16.13)	6 (14.29)	14 (11.76)
Gastrointestinal disorders	2 (4.65)	NA#	13 (41.94)	12 (28.57)	27 (22.69)
Anemia	NA	NA	NA	2 (4.76)	2 (1.68)
Diabetes	6 (13.95)	NA	3 (9.68)	2 (4.76)	11 (9.24)
Thyroid diseases	3 (6.98)	NA	1 (3.23)	5 (11.90)	9 (7.56)
Antidepressant or antianxiety	NA	NA	NA	1 (2.34)	1 (0.84)
Local irritants	3 (6.98)	NA	NA	5 (11.90)	8 (6.72)

* Visual analog scale score was the same as before. † Visual analog scale score was higher than before. ‡ Visual analog scale score was lower than before. § Visual analog scale score was 0. ¶ Including self-care and assurance. # NA: Not applicable.

Treatment follow-up in patients without BMS

In 119 patients without BMS who agreed to participate in the subsequent follow-up study, 72 had received referrals and treatment for primary systemic diseases. Of these 72 patients, 25 had more than 1 systemic disease in addition to the primary diagnosis, and the secondary diagnoses of systemic disease included hyperlipidemia, hypertension (with no history of taking angiotensin-converting enzyme inhibitors), and thyroid nodule (with normal thyroid hormone level). In these 72 patients, 76.39% achieved complete (35.83%) or partial (30.56%) remission. Among them, treatment for gastrointestinal disorders (92.59%, 25 of 27), oral candidiasis (78.57%, 11 of 14), thyroid diseases (66.67%, 6 of 9), and avoidance of local irritants (62.5%, 5 of 8) were most effective and were perpetuated as the common underlying causes (Table 5).

DISCUSSION

Patients with burning mouth sensation are frequently encountered in dental clinics, yet studies on burning mouth sensation are relatively limited.[1,2] Due to the disturbing nature of typical symptoms, impact on QoL,[3] decrease in functional activity,[23] and increase in health costs,[24] evaluation of burning mouth sensation is of considerable importance. Diagnosis and treatment management of burning mouth sensation has been challenging for dentists because of the diverse and multifactorial etiology. We designed our study to provide recommendations for a diagnosis and treatment management strategy for this complex and multifactorial condition.

Burning mouth sensation is experienced as an uncomfortable burning and, often frustrating, pain in the oral mucosa. Clinically, although it is 1 of the main clinical features of BMS and can act as an indicator of the presence of BMS, the etiology of burning mouth sensation is more complicated and can be attributed to both systemic conditions and local factors. In our study, although BMS was the most common provisional diagnosis in these patients, only one-third of patients with burning mouth sensation eventually received a diagnosis of BMS, and the remaining two-thirds of patients' symptoms were frequently secondary to systemic diseases, oral mucosal diseases, or local irritants. For patients with burning mouth sensation, obtaining an accurate and precise history targeting the main symptom is fundamental to providing differential information and reaching a possible diagnosis. It is important to obtain a comprehensive patient history by means of a thorough review of the systems and symptoms (that is, onset, course, severity, associated symptom, and previous episodes). The differential diagnosis of burning mouth sensation can be challenging, and it is important for clinicians to review systemic conditions thoroughly, complete laboratory tests, and examine the oral cavity of patients with burning mouth sensation symptoms carefully to avoid overdiagnosis of BMS.

There were no significant differences found for age, sex, and clinical characteristics between BMS and no BMS groups. All of the oral mucosae can be involved as the symptom site of burning mouth

sensation, and there were no significant differences between groups in location of symptoms; accompanying symptoms, such as xerostomia; and altered taste. Our findings indicated that it was challenging to differentiate the variable underlying causes from the clinical dimension alone. In addition, we found that approximately 50% of patients reported sleep problems, and no significant differences were found between BMS and no BMS groups. The relationship between sleep and chronic pain has been investigated widely. Almoznino and colleagues[25] reported a significant correlation between sleep problems and chronic orofacial pain disorders (such as primary headaches and temporomandibular disorders). The role of sleep disorders warrants additional consideration in the diagnosis and treatment management of these patients.

Burning mouth sensation is a common symptom and affects patient QoL. Because it is primarily a subjective symptom, assessment relies mainly on patient self-reports. In our study, we found that the QoL of patients with burning mouth sensation was impaired mainly in terms of psychological discomfort, psychological disability, and physical pain dimensions, and there were no significant differences found between BMS and no BMS groups. Among the clinical characteristics, VAS was significantly associated with OHIP-14 score, and other dimensions, including duration of symptom, altered taste, xerostomia, and location, were not significantly associated with the OHIP-14 scores in both groups. Although it is widely accepted that chronic pain without adequate relief or treatment can have extensive adverse impacts on all aspects of patient QoL,[18,26,27] published studies focused exclusively on BMS. In our study, we found that burning mouth sensation, regardless of the origin of the symptoms, had a similar impact on QoL.

In the past decade, health care professionals have become increasingly interested in BMS because of its prevalence and impact on the community. However, on the basis of the findings that BMS was clinically difficult to distinguish from other conditions causing similar symptoms, it is particularly appropriate to manage uninvestigated burning mouth sensation at the primary care level using the test and treat approach. The test and treat approach involves the use of a diagnostic test or assessment in conjunction with a therapeutic intervention, which means the use of the treatment is dependent on the results of the preceding test.[28] In our study, patients who were identified with anemia and depression after the relevant tests obtained complete remission at follow-up. Similarly, in patients who received a diagnosis of a gastrointestinal disorder, including gastroesophageal reflux disease, 92.59% obtained complete or partial remission after receiving relevant treatment. To summarize, contrary to the symptoms and treatment approach, which aims to eliminate the symptoms as symptom driven, the test and treat strategy is appropriate and recommended for the management of care for patients with burning mouth sensation. For such purpose, it is important for dentists and physicians to collaborate on relevant clinical and laboratory tests and to integrate multidisciplinary treatment for burning mouth sensation.

Our study was a retrospective cohort study of patients with burning mouth sensation symptoms in a relatively large population. However, there are several limitations. First, given the retrospective nature of our study, the integrity and reliability of the clinical data of patients are limited; for example, the initial VAS score was hard to recover. Second, because chronic pain is associated with race, the patients included in our study inevitably had regional limitations. Third, due to the COVID-19 pandemic and the restrictions of infection prevention and control policies, only approximately 29.4% of patients without BMS were able to follow-up. This led to the absence of prognostic information for a number of patients and increased the follow-up bias of our study. Therefore, more high-quality studies from multiple regions are required to achieve a multidimensional understanding of burning mouth sensation.

CONCLUSIONS

The diagnosis and evaluation of burning mouth sensation pose challenges and adversely affect health. Management must include identification of the underlying causes and the test and treat strategy is recommended. ■

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1. Klasser GD, Epstein JB, Villines D. Diagnostic dilemma: the enigma of an oral burning sensation. *J Can Dent Assoc*. 2011;77:b146.

2. Pereira JV, Normando AGC, Rodrigues-Fernandes CI, Rivera C, Santos-Silva AR, Lopes MA. The impact on quality of life in patients with burning mouth syndrome: a systematic review and meta-analysis. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2021;131(2):186-194.

3. Bergdahl M, Bergdahl J. Burning mouth syndrome: prevalence and associated factors. *J Oral Pathol Med*. 1999; 28(8):350-354.

4. Suzuki N, Mashu S, Toyoda M, Nishibori M. Oral burning sensation: prevalence and gender differences in a Japanese population. *Pain Pract*. 2010;10(4):306-311.

5. Aggarwal A, Panat SR. Burning mouth syndrome: a diagnostic and therapeutic dilemma. *J Clin Exp Dent*. 2012;4(3):e180-e185.

6. Ni Riordain R, O'Dwyer S, McCreary C. Burning mouth syndrome: a diagnostic dilemma. *Ir J Med Sci*. 2019; 188(3):731-734.

7. Mignogna MD, Fedele S, Lo Russo L, Leuci S, Lo Muzio L. The diagnosis of burning mouth syndrome represents a challenge for clinicians. *J Orofac Pain*. 2005; 19(2):168-173.

8. Klasser GD, Epstein JB, Villines D, Utsman R. Burning mouth syndrome: a challenge for dental practitioners and patients. *Gen Dent*. 2011;59(3):210-222.

9. Mansoor H, Tan HC, Lin MT, Mehta JS, Liu YC. Diabetic corneal neuropathy. *J Clin Med*. 2020;9(12):3956.

10. Scala A, Checchi L, Montevecchi M, Marini I, Giamberardino MA. Update on burning mouth syndrome: overview and patient management. *Crit Rev Oral Biol Med*. 2003;14(4):275-291.

11. Maier H, Tisch M. Mundtrockenheit und mundschleimhautbrennen: ursachen und therapiemöglichkeiten. *HNO*. 2003;51(9):739-747.

12. Freilich JE, Kuten-Shorrer M, Treister NS, Woo SB, Villa A. Burning mouth syndrome: a diagnostic challenge. *Oral Surg Oral Med Oral Pathol Oral Radiol*. 2020;129(2):120-124.

13. Treede RD, Rief W, Barke A, et al. Chronic pain as a symptom or a disease: the IASP Classification of Chronic Pain for the International Classification of Diseases (ICD-11). *Pain*. 2019;160(1):19-27.

14. Wu S, Zhang W, Yan J, Noma N, Young A, Yan Z. Worldwide prevalence estimates of burning mouth syndrome: a systematic review and meta-analysis. *Oral Dis*. 2022;28(6):1431-1440.

15. Mukatash-Nimri GE, Al-Nimri MA, Al-Jadeed OG, Al-Zobe ZR, Aburumman KK, Masarwa NA. Patients with burning mouth sensations: a clinical investigation of causative factors in a group of "compete denture wearers" Jordanian population. *Saudi Dent J*. 2017;29(1):24-28.

16. International Association for the Study of Pain. *IASP Orofacial Pain Fact Sheet: Burning Mouth Syndrome*. International Association for the Study of Pain; 2016.

17. International Classification of Orofacial Pain, 1st edition (ICOP). *Cephalalgia*. 2020;40(2):129-221.

18. Adamo D, Pecoraro G, Fortuna G, et al. Assessment of oral health-related quality of life, measured by OHIP-14 and GOHAI, and psychological profiling in burning mouth syndrome: a case-control clinical study. *J Oral Rehabil*. 2020;47(1):42-52.

19. Slade GD. Derivation and validation of a short-form oral health impact profile. *Community Dent Oral Epidemiol*. 1997;25(4):284-290. http://dx.doi.org/10.1111/j.1600-0528.1997.tb00941.x

20. Sousa VD, Rojjanasrirat W. Translation, adaptation and validation of instruments or scales for use in cross-cultural health care research: a clear and user-friendly guideline. *J Eval Clin Pract*. 2011;17(2):268-274.

21. Slade GD. Derivation and validation of a short-form oral health impact profile. *Community Dent Oral Epidemiol*. 1997;25(4):284-290.

22. Rodakowska E, Mierzyńska K, Bagińska J, Jamiołkowski J. Quality of life measured by OHIP-14 and GOHAI in elderly people from Bialystok, north-east Poland. *BMC Oral Health*. 2014;14:106.

23. Ariyawardana A, Chmieliauskaite M, Farag AM, et al. World Workshop on Oral Medicine VII: burning mouth syndrome—a systematic review of disease definitions and diagnostic criteria utilized in randomized clinical trials. *Oral Dis*. 2019;25(suppl 1):141-156.

24. Tinnirello A, Mazzoleni S, Santi C. Chronic pain in the elderly: mechanisms and distinctive features. *Biomolecules*. 2021;11(8):1256.

25. Almoznino G, Benoliel R, Sharav Y, Haviv Y. Sleep disorders and chronic craniofacial pain: characteristics and management possibilities. *Sleep Med Rev*. 2017;33:39-50.

26. Braud A, Boucher Y. The relationship between the clinical features of idiopathic burning mouth syndrome and self-perceived quality of life. *J Oral Sci*. 2016;58(4):475-481.

27. Grushka M, Sessle BJ, Miller R. Pain and personality profiles in burning mouth syndrome. *Pain*. 1987;28(2): 155-167.

28. Rector TS, Taylor BC, Wilt TJ. Systematic review of prognostic tests. In: Chang SM, Matchar DB, Smetana GW, et al., eds. *Methods Guide for Medical Test Reviews*. Agency for Healthcare Research and Quality; 2012. AHRQ publication 12-EHC017.