Burning Mouth Syndrome Questionnaire

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INTRODUCTION

Burning mouth syndrome (BMS) is a condition characterized by the presence of burning sensation involving the oral mucosa and/or tongue, usually without the evidence of either local or systemic disorder[1]. Population studies have shown a wide range of prevalence for BMS, ranging from 0.7% to 15%, owing to the controversy associated with its diagnosis[2-5]. It predominantly affects women, especially of postmenopausal age, with a female to male ratio of 7:1[5].

Patients usually complain of pain and/or burning sensation, most commonly involving the anterior 2/3^{rds} of the tongue bilaterally, followed by dorsal and lateral surfaces of tongue, anterior hard palate and labial mucosa[6, 7]. It usually is of spontaneous onset[8], however previous illness, any dental procedure, medication use and traumatic stressors have also been shown to be contributing to the onset of BMS symptoms[9-11]. Personal stressors, acidic, spicy and thermally hot foods are known to aggravate BMS symptoms, whereas function and movement of the tongue, such as during eating and talking, are shown to relieve some of the symptoms[6, 12, 13]. The burning sensation can present with other symptoms such as dry mouth and taste alterations. Taste alterations can be either a change in taste intensity or an abnormal taste sensation such as presence of metallic or bitter taste in the mouth [6, 7, 14, 15]. BMS symptoms are usually continuous and last for months or years without any periods of remission. However, reports of either partial or complete remission of BMS symptoms within 5-7yrs from the onset have been published[16].

The exact etiology of BMS is not known, although BMS is thought to be a neuropathic phenomenon[17]. Lauria et al[18] showed a significant reduction in the density of epithelial nerve fibers on tongue in patients with BMS compared with that found in the controls, suggesting it to

be a peripheral neuropathic phenomenon. Some investigators showed a difference in the trigeminal pain perception and decreased dopaminergic inhibition in BMS patients compared to that in the normal controls, suggesting it to be a central neuropathic phenomenon[19, 20]. Some investigators have also suggested BMS to be an oral phantom pain because of the damage to the gustatory system[21, 22].

Though Scala et al[23] tried to identify different diagnostic criteria for BMS, its diagnosis still poses a great challenge for the clinicians. Based on etiology, BMS can be classified into two groups:

1. Primary/idiopathic/essential BMS – where the reason for the development of symptoms is unknown
2. Secondary BMS/secondary oral burning – where the development of symptoms can be attributed to a known local, systemic or psychological cause

A number of local, systemic and psychological factors have been shown to be responsible for the development of secondary BMS [24] (Table 1).

Table 1: Factors Contributing To The Development Of Secondary Burning Mouth Syndrome.

Local factors	**Systemic factors**	**Psychological factors**
Dental/denture factors **Mechanical/chemical factors** - galvanism[25] **Para-functional factors** – bruxism, tongue posture[26] **Allergy/contact hypersensitivity** – to dental materials, foods **Oral mucosal diseases** – oral lichen planus, benign migratory glossitis **Infections** – bacterial, fungal and viral[27] **Xerostomia/hyposalivation** – salivary gland disorders, post-radiation therapy[28] **Taste alterations** **Neurological factors**	**Nutritional deficiency** – vitamins, iron, folate, zinc[29] **Endocrinal factors** – diabetes, hypothyroidism, hormonal imbalance/menopause[30, 31] **Xerostomia/hyposalivation** – Sjögren's syndrome, drug-induced[32], connective tissue disorders, systemic lupus erythematosus (SLE) **Gastric esophageal reflex disease** (GERD)[33] **Medications** – ACE inhibitors, hypoglycemic medications **Central nervous system disorders** – multiple sclerosis, Parkinson's disease, trigeminal neuralgia	Anxiety[34] Depression Somatization with and without pain[35] Psychosocial stressors Obsessive compulsive disorder[36]

Treatment of BMS is dependent upon the etiology of the condition. So it is very important to differentiate the primary BMS from the secondary, as it will aid in the proper management of the condition. In the primary BMS where the etiology is not known, various topical and systemic medications such as clonazepam, doxepin, viscous lidocaine, tricyclic anti-depressants, anti-convulsants and other medications[17, 24], and behavioral modification methods using tongue protectors[37] and cognitive behavioural management[38] were shown to be effective in alleviating the BMS symptoms (Table 2). However, in cases of secondary BMS where there is a known etiological cause, identification and treatment of those causes will help with the BMS symptoms. Different ways to identify these etiological factors are: a thorough intra-oral examination to check for the presence of oral lesions, infections, stomatitis and for the other local factors listed in Table 1; lab tests to identify nutritional, vitamin and hormonal deficiencies; measurement of salivary flow rates to diagnose xerostomia (salivary flow rates below 0.1 mL/min for unstimulated whole saliva and/or 0.7 mL/min for stimulated whole saliva are suggestive of hypo-salivation[39]) and the symptom check list, scl-90r, questionnaire to assess the influence of psychological factors.

Table 2: Treatment Options For The Burning Mouth Syndrome.

Topical treatment	**Systemic treatment**	**Behavioural/Cognitive treatment**
- Clonazepam 0.5-1mg x 2-3/day[40, 41] - Doxepin 5% cream x 3-4/day[42] - Viscous Lidocaine 2% in 5ml x 3-4/day[43] - Capsaicin 0.025% cream x 3-4/d[44] - Benzydamine hydrochloride 0.15% oral rinse[45] - Sucralfate 20% suspension or 1mg tab - Lactoperoxidase in oral solution	- <u>TCA[42]:</u> Nortriptyline 10mg/d Amitriptyline 25mg/d Amisulpiride 50mg/d Levosulpride 100mg/d - <u>Anticonvulsants[46]:</u> Gabapentin 300-2400mg/d Topiramate 100-300mg/d - <u>Benzodiazepines:</u> Clonazepam 0.25-3mg/d Chlordiazepoxide 10-30mg/d - <u>SSRI:</u> Paroxetine 20mg/d[47] Setraline 50mg/d -Pramipexole 0.5mg/d -Trazodone 200mg/d[48] -Bethanechol 15mg/d[49] -Alpha lipoic acid 200-600mg/d[50, 51] -Capsaicin 0.25% cap x3/d[52]	- Tongue protector[37] - Cognitive behavioural management[38]

There are other neuropathic pain conditions in the mouth such as atypical odontalgia, trigeminal neuralgia and post-traumatic nerve injuries that can also present as “burning” in the mouth with or without an associated pain. Atypical odontalgia (AO), which is also known as idiopathic tooth-ache, is a chronic neuropathic pain condition with persistent pain in the tooth or

in a tooth socket after an extraction with no signs of any pathology[53, 54]. Dental and surgical procedures, such as extraction, root canal therapy, dental injections, apicoectomy and orthognathic surgical procedures are thought to be associated with the onset of AO[55] and post-traumatic trigeminal neuropathic pain[56, 57]. However, there are no known diagnostic screening tools available which could help the clinicians to identify and differentiate BMS (both primary and secondary) from these other neuropathic pain conditions in the mouth. So, the objective of this study was to develop a screening questionnaire which could help differentiating, 1) BMS from other neuropathic pain conditions in the mouth, and, 2) primary BMS from the secondary BMS.

MATERIALS AND METHODS

Sample Population and Criteria for Selection

Two groups of human subjects were included in this study, which are:

Group 1: Patients who already have an existing diagnosis of burning mouth syndrome and seeking care at the Oral Medicine clinic, University of Washington

Group 2: Patients who already have an existing diagnosis of atypical odontalgia, trigeminal neuralgia and traumatic neuropathic pain in their mouth with or without facial involvement and seeking care at the Oral Medicine clinic, University of Washington

Exclusion criteria:

Groups 1:

- Patients with a chief complaint of dry mouth and/or changes in taste sensation in their mouth without an associated complaint of burning sensation
- Patients with a chief complaint of burning sensation only in the face without the presence of burning sensation in their mouth

Group 2:

- Patients with a chief complaint of pain in their jaws and/or facial muscles. Ex: pain in the temporo-mandibular joint (TMJ) area, pain in the muscles of mastication and/or muscles of facial expression
- Patients with a chief complaint of headaches

- Patients with a chief complaint of neuropathic pain in their face without a complaint of neuropathic pain in their mouth. Ex: Atypical Facial Pain (AFP), facial neuralgias, neuropathic pain secondary to TMJ surgery

Patient Screening

An IRB approval for the 'waiver of requirement for HIPPA authorization' was obtained to screen the Oral Medicine Clinical Services (OMCS) patient database in AxiUm to identify patients who would meet the inclusion criteria and could be included in the study. No flyers or advertisements were used to recruit the subjects into the study.

Patient Recruitment

The study was first introduced to the prospective participants by their Oral Medicine clinicians. If the patients were willing to participate in the study, then the investigator spoke with them about the details of the research project in a private dental operatory, to protect the subjects' privacy. It was clearly explained to all the participants that the participation in this research study was completely voluntary and it would not affect their regular health care at the oral medicine clinic or any other clinic in the University of Washington.

Questionnaire Development

Taking the already existing information in the literature on both the BMS and the other neuropathic pain conditions in the mouth, such as the etiology, location of the symptoms, aggravating and relieving factors and presence or absence of other symptoms such as dry mouth, we developed our preliminary questionnaire. As a trial, we distributed this questionnaire to few patients in the Oral medicine clinic and their responses on the user-friendleyness of the

questionnaire were collected using some survey questions. Then modifications were made and finally a questionnaire with 12 questions (see the Oral Burning Checklist below) was developed to be used for the study. This questionnaire was given to the all the recruited participants at the time of their visit at the OMCS. Written consent was obtained from all the participants who were willing to participate in the study before the questionnaires were given to them. Participants were asked to fill out the questionnaire and return it to the investigator before leaving the clinic. The responses to the questions in the questionnaire were purely subjective, no objective measures were used to assess the salivary, taste and smell dysfunction.

Sample Size

After consulting a statistician and doing power analysis using G power[58], to achieve an effect size of 0.5 (large), α of 0.05 and β of 0.20 (and Power of 0.80) for chi-square analysis, the total sample size was calculated to be 32. However, we were able to include a total of 34 subjects (n=11 in Group1 and n=23 in Group2) in this pilot study, for which the achieved Power was 0.83.

Statistical Analysis

Descriptive statistics were calculated. Chi-square analyses were performed to identify statistically significant differences in the responses to each of the question in the questionnaire, between the two groups. $P<0.05$ was considered statistically significant.

Compliance

The study design and protocol were approved by the Institutional Review Board (IRB) at the Human Subjects Division (HSD), University of Washington School of Dentistry.

Oral Burning Checklist

1. **Have you ever had persistent pain and/or burning sensation in your mouth in the last 12months?** (Please check mark (✓) an appropriate answer)

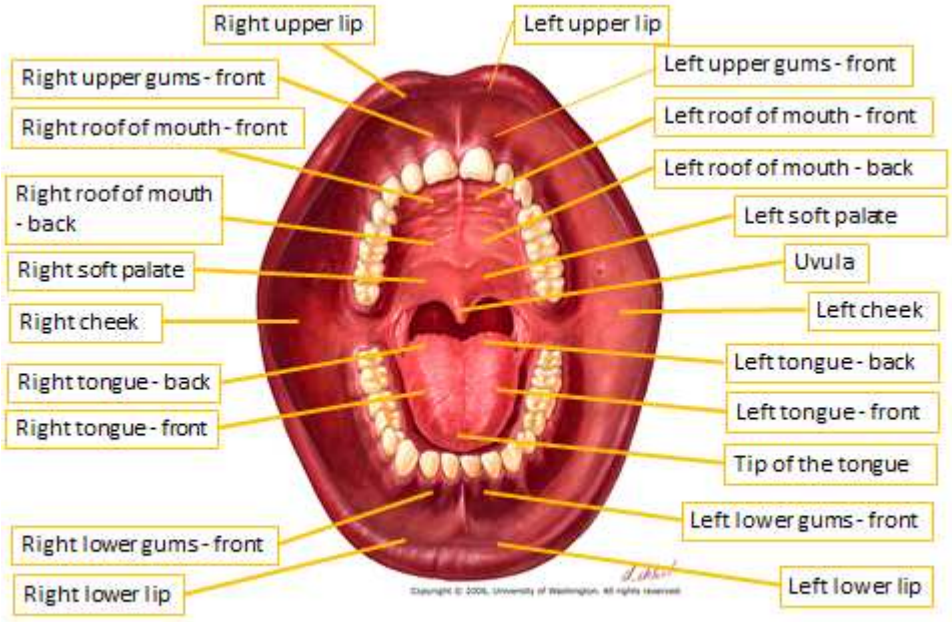
   O Yes O No

   If yes, please describe your current problem.

   O Pain O Burning sensation O Both

2. **LOCATION OF YOUR CURRENT PROBLEM**

   Please put a check mark (✓) beside the appropriate box or boxes in the diagram below to show where your pain or burning located.



3. Does the severity of the current problem change or remain constant throughout the day?

   (Please check mark (✓) an appropriate answer)

   O Remains constant throughout the day O Changes in severity over the day

   If it changes in severity over the day, when is the problem worst?

   O On awakening O During the day O In the evening O At night

4. DID ANY OF THE FOLLOWING OCCUR AT THE BEGINNING OF YOUR CURRENT PROBLEM?

(Please put a check mark (✓) in the appropriate box)	**YES**	**NO**	**IF YES, PLEASE DESCRIBE**
Bacterial infection(s) – such as Strep. Throat/sore throat			
Viral infection(s) – such as herpes/cold sores			
Fungal infection(s) – such as yeast/thrush			
Trauma to face			
Nutritional or Vitamin deficiency			
Change in the appearance of tongue/lips/gums/cheeks/roof of the mouth			
Dental treatment(s)			

5. HOW DO THE FOLLOWING FACTORS AFFECT YOUR CURRENT PROBLEM?

(Please put a check mark (✓) in the appropriate box)	**NO EFFECT**	**MAKES IT BETTER**	**MAKES IT WORSE**
Eating or chewing			
Talking			
With the movement of the tongue – as in when the tongue touches the roof of mouth			
Acidic food(s) – as in salad dressing, lime/lemon			
Salty food(s)			
Spicy food(s)			
Hot temperature food(s) – as in hot coffee, hot soup			
Cold temperature food(s) – as in ice cream, cold drink			
Stress			
Analgesic/Anti-inflammatory medication(s) – such as Tylenol, Ibuprofen			
Anti-fungal medication(s) – for yeast/thrush			
Dental treatment(s)			
Other(s)			

For questions 6-12; please check (✓) an appropriate answer.

6. Do you have difficulty chewing and/or swallowing food without sipping a beverage?
   O Yes O No
7. In general, does your mouth feel dry? O Yes O No
   If yes, please describe your dry mouth since the beginning of your current problem.
   O It is better since the beginning of the current problem
   O It is worse since the beginning of the current problem
   O No change in the dry mouth since the beginning of the current problem
8. Does the thickness of your saliva seem to have changed since the beginning of your current problem?
   O Yes O No
   If yes, please describe the change in the saliva thickness.
   O Saliva feels thick O Saliva feels thin O Saliva feels stringy
9. **BEFORE** the beginning of your current problem, did you ever experience a change in your taste sensation?
   O Yes O No
10. Has your taste sensation changed **AFTER** the beginning of your current problem?
    O Yes O No
    If yes, please describe the change in your taste sensation with respect to each taste
    - Sweet taste - O Increased O Decreased O No change
    - Sour taste - O Increased O Decreased O No change
    - Salt taste - O Increased O Decreased O No change
    - Bitter taste - O Increased O Decreased O No change
    - Presence of metallic taste in mouth - O Yes O No
11. **BEFORE** the beginning of your current problem, did you ever experience a change in your sense of smell?
    O Yes O No
12. Has your sense of smell changed **AFTER** the beginning of your current problem?
    O Yes O No
    If yes, please describe the change in your sense of smell.
    O Increased sense of smell O Decreased sense of smell

RESULTS

We recruited 11 Subjects in Group 1, 10 females and 1 male, and 23 subjects in Group 2, 19 females and 4 males, for the study.

When the participants were asked about their chief complaint, all of them reported that they had persistent pain and/or burning sensation in their mouth in the last 12months (Table 3). In Group 1, 10 patients reported to have had both pain and burning in the mouth, 1 patient reported only burning, whereas none reported to have had only pain in the mouth. In Group 2, 13 patients reported to have had only pain, 3 patients reported only burning and 7 patients reported both pain and burning in the mouth (Table 3).

Table 3: Chief Complaint

Question	**Group 1 (n=11; F=10;M=1)**		**Group 2 (n=23; F=19;M=4)**		**Statistics between groups**	
	YES	**NO**	**YES**	**NO**		
1. **Have you ever had persistent pain and/or burning sensation in your mouth in the last 12months?**	11		23			
a. Pain	0		13		**P=0.002**	The majority of the chronic neuropathic pain pts reported 'pain' in the mouth as their current problem
b. Burning sensation	1		3		P=0.738	
c. Both	10		7		**P=0.001**	The majority of the oral burning pts reported both 'pain & burning' in the mouth as their current problem

The majority of the patients in Group 1 reported their symptoms were in the dorsal and lateral borders of tongue, tip of the tongue and the hard palate. The majority of the patients in

Group 2 reported their symptoms were unilateral and involved the upper and lower gums and hard palate (data not shown). Patients in both the groups reported that their symptoms change in severity over the day. The majority of the patients in Group 1 reported that their symptoms were worst in the evening; where as patients in Group 2 reported that their symptoms were worst during the day and also in the evening (Table 4).

Table 4: The Nature Of The Severity Of The Chief Complaint

Question	**Group 1 (n=11; F=10;M=1)**		**Group 2 (n=23; F=19;M=4)**		**Statistics between groups**	**Inference**
3. Does the severity of the current problem change or remain constant throughout the day?	**YES**	**NO**	**YES**	**NO**		Majority of pts in both the groups reported that their condition "changes in severity over the day"
a. Remains constant	0	11	2	21	P=0.313	
b. Changes in severity	11	0	21	2	P=0.313	
Worst on awakening	2		6		P=0.611	
Worst during the day	5		11		P=0.897	
Worst in the evening	10		12		**P=0.027**	Majority of pts with oral burning reported that their condition was "worst in the evening"
Worst at night	3		6		P=0.942	

When the participants were asked if any event, such as infection, trauma to the face or dental treatment, happened at the time of the onset of the current problem, the majority of the patients in Group 2 reported that they had some sort of dental treatment and this finding it was statistically significant (Table 5).

Table 5: History At The Time Of Onset Of The Current Problem

Question	Group 1 (n=11; F=10;M=1)		Group 2 (n=23; F=19;M=4)		Statistics between groups	Inference
4. Did any of the following occur at the beginning of your current problem?	**YES**	**NO**	**YES**	**NO**		
Bacterial infection(s)	1	10	2	21	P=0.97	
Viral infection(s)	0	11	0	23		
Fungal infection(s)	1	10	1	22	P=0.582	
Trauma to face	0	11	5	18	P=0.094	
Nutritional or Vitamin deficiency	1	10	1	22	P=0.582	
Change in the appearance of tongue/lips/gums/ cheeks/roof of the mouth	3	8	2	21	P=0.152	
Dental treatment(s)	4	7	17	6	**P=0.035**	Majority of the chronic neuropathic pain pts reported that they had 'dental treatment' at the time of the onset of their current problem

When asked about the possible aggravating and relieving factors influencing the current problem, the majority of the patients in Group 1 reported that any oral function such as eating or chewing made their condition better, whereas patients in Group 2 reported that eating or chewing made their condition worse and this difference was statistically significant. Patients in Group 1 reported that salt and spicy foods made their oral burning symptoms worse; whereas patients in Group 2 reported that any dental procedure made their symptoms worse (Table 6).

Table 6: Affect Of Some Of The Factors On The Severity Of The Current Problem

Question	Group 1 (n=11; F=10;M=1)			Group 2 (n=23; F=19;M=4)			Statistics between groups	Inference
5. How do the following factors affect your current problem?	**NO CHANGE**	**MAKES IT BETTER**	**MAKES IT WORSE**	**NO CHANGE**	**MAKES IT BETTER**	**MAKES IT WORSE**		Most of the pts. with oral burning reported that "eating/chewing" made their current problem better. Whereas, pts. with chronic neuropathic pain in the mouth reported that "eating/chewing" made their current problem worse.
Eating or chewing	3	7	1	6	2	15	**P=0.001**	
Talking	6	2	3	10	0	13	P=0.057	
With the movement of the tongue – as in when the tongue touches the roof of mouth	4	1	6	12	1	10	P=0.646	
Acidic food(s)	6	0	5	19	0	4	P=0.083	
Salty food(s)	7	0	4	21	1	1	**P=0.042**	Pts. with oral burning reported that salt and spicy foods made their symptoms worse
Spicy food(s)	5	1	5	19	2	2	**P=0.042**	
Hot temperature food(s)	6	0	5	16	0	7	P=0.391	
Cold temperature food(s)	6	2	3	14	2	7	P=0.724	
Stress	5	0	6	7	0	16	P=0.391	
Analgesic/Anti-inflammatory medication(s)	7	2	2	14	8	1	P=0.313	
Anti-fungal medication(s)	10	0	1	18	4	1	P=0.31	
Dental treatment(s)	8	3	0	13	0	10	**P=0.003**	Pts with chronic neuropathic pain in the mouth reported that any 'dental tx' made their symptoms worse

When asked about the feeling of dry mouth, the majority of the patients in Group 1 (8/11) reported that their mouth felt dry and it was statistically significant compared to the reported feeling of dry mouth in Group2 (Table 7). Out of these patients, the majority (5/8) reported that

this feeling was worse since the onset of the current problem. There were no significant differences found between the groups regarding the chnages in the consistency of the saliva (Table 7).

Table 7: Oral Dryness And Salivary Thickness Changes In Relation To The Current Problem

Question	**Group 1 (n=11; F=10;M=1)**		**Group 2 (n=23; F=19;M=4)**		**Statistics between groups**	**Inference**
	YES	**NO**	**YES**	**NO**		
6. Do you have difficulty chewing and/or swallowing food without sipping a beverage?	1	10	5	18	P=0.365	
7. In general, does your mouth feel dry?	8	3	8	15	**P=0.038**	Majority of the pts with oral burning reported 'feeling dry mouth' and it being 'worse' since the onset of their current problem
Since the onset of current problem:						
Better	1		2			
Worse	5		3			
No change	1		2			
8. Does the thickness of your saliva seem to have changed since the beginning of your current problem?	3	8	4	19	P=0.505	
Saliva feels thick	1		2			
Saliva feels thin	1		1			
Saliva feels stringy	2		1			

When asked about the association of the current problem with change in taste sensation, though no statistically significant differences were found between the two groups, few patients reported a change in taste sensation since the onset of their current problem. In Group 1, the change in taste sensation was a decrease in the sweet and salt tastes; whereas in Group 2, the change in taste sensation was a combination of an increase and a decrease in sweet, sour, salt and bitter tastes. The change in salt taste between the 2 groups was statistically significant (Table 8).

Table 8: Taste Changes In Relation To The Current Problem

Question	Group 1 (n=11; F=10;M=1)		Group 2 (n=23; F=19;M=4)		Statistics between groups
9. Did you ever experience a change in your taste sensation?	YES	NO	YES	NO	
Before the onset of current problem	0	11	4	19	P=0.141
After the onset of current problem	6	5	8	15	P=0.273
Sweet	4→decreased		3→decreased		P=0.116
Sour			2→decreased 4→increased		P=0.455
Salt	4→decreased		1→decreased 2→increased		P=0.024
Bitter			2→decreased 4→increased		P=0.175
Presence of metallic taste	3	8	6	17	P=0.942

When asked about the changes in smell sensation, patients in both the groups reported no statistically significant differences in the changes in the sense of smell either before or after the onset of their current problem (Table 9).

Table 9: Smell Changes In Relation To The Current Problem

Question	Group 1 (n=11; F=10;M=1)		Group 2 (n=23; F=19;M=4)		Statistics between groups
11. Did you ever experience a change in your sense of smell?	YES	NO	YES	NO	
Before the onset of current problem	1	10	2	21	P=0.97
After the onset of current problem	2	9	1	22	P=0.183
Decrease in smell	2		1		
Increase in smell	0		0		

DISCUSSION

Burning mouth syndrome (BMS) is a chronic condition characterized by the presence of burning in the oral mucosa and tongue[1]. It has been reported in the literature that the symptoms of BMS start spontaneously without any known and identifiable triggering factors[1]. As mentioned in the Introduction, there are other chronic neuropathic pain conditions in the mouth, such as atypical odontalgia (AO), oro-facial neuralgias and trigeminal neuropathic pain, which share similar pathophysiological mechanisms with BMS, taking a thorough clinical history can be a helpful tool in separating these conditions.

In our study, we found that the majority of patients in Group1 (BMS) reported to have both burning and pain in their mouth (Table 3), mostly involving the bilateral lateral borders of the tongue, tip of the tongue and the hard palate. None of the patients in Group1 reported any history of infection, trauma or dental treatment at the time of onset of their oral burning. In contrast, the majority of the patients in Group 2 (other oral chronic neuropathic pain conditions) reported having undergone some dental procedure at the time of onset of their problem (Table 5). This finding suggests that in our study population, BMS is of idiopathic origin and neuropathic pain has traumatic nerve origin. Therefore, a clear history regarding the presence or absence of the triggering factors and traumatic events at the time of onset of the symptoms is very important as it might help in differentiating BMS from other chronic neuropathic pain conditions.

Lamey et al[59] classified BMS into 3 types based on the symptoms. Patients with oral burning report minimal or no symptoms on awakening but the symptoms gradually worsen during the day and there is a reported decrease in symptoms with function such as eating and mastication[60]. In our study, majority of the patients in Group1 reported that their symptoms were worst in the evening (Table 4). Patients in Group1 reported that oral function, such as eating and

chewing, made their oral burning better, where as patients in Group2 reported that it made their oral pain worse. The reason for this finding is not known, however it is believed that any oral function might act as a distracting mechanism and a sensory trick, thus reducing the oral burning. Local stressors such as spicy and salty foods were reported to make the oral burning significantly worse, whereas they did not change the neuropathic oral pain. On the other hand, dental procedures were reported to make the oral pain significantly worse in Group2, whereas they did not change the oral burning in Group1 (Table 6).

Increased incidence of dry mouth was reported with BMS[60]. However, no significant changes in the salivary flow rates were reported[61]. In our study, the majority of the patients in Group1 reported 'feeling dry in their mouth' compared to the patients in Group2 and this was statistically significant (Table 7). However, in this study we did not measure their salivary flow rates. When we looked into the chart notes of these patients provided by their Oral Medicine care providers, all of them had a diagnosis of primary BMS. Of the 8 patients who reported the feeling of dry mouth, 3 patients were put on a trial of Pilocarpine, a sialagogue, to observe if it would help their dry mouth and oral burning. Only one patient reported to have had some benefit after being on pilocarpine, and she was also taking clonazepam for oral burning. She reported that though pilocarpine helped her dry mouth, it did not help her oral burning and if she doesn't take clonazepam as prescribed, her oral burning would become worse. This finding suggests that though BMS and the feeling of dry mouth may co-exist, it is important to assess whether the feeling of dry mouth in BMS patients is actually because of a decreased salivary flow rate or if its a neurological alteration in the sensation.

It's reported in the literature that BMS is associated with changes in the senses of taste and smell[62]. Change in taste sensation, from injury to the chorda tympani, is reported to increase the

trigeminal sensations such as pain, touch perception, dry mouth and phantom sensations[62], thus contributing to the symptoms of BMS. Injury to chorda tympani reported to cause changes in the bitter sensation in the anterior 2/3rds of the tongue[63]. In our study, some patients in both the groups reported changes in taste sensation since the onset of their current problem, but it was not significantly different between the groups (Table 8). None in Group1 reported any changes in the bitter sensation. From our results, we were not able to observe an association between the changes in the taste (bitter) sensation and the onset of the BMS symptoms. However, taste function was not objectively assessed. Hirsch et al[64] in their study hypothesized that taste dysfunction, especially the sweet taste, can produce BMS symptoms. In their study they showed that treating sweet taste hypo-function with sucralose decreased BMS symptoms in 3 patients. Few patients in our Group1 reported a decrease in sweet taste sensation in their mouth. However, a study with a bigger sample size is needed to further evaluate this association between taste dysfunction and BMS.

Siviero et al[65] in their study reported an increase in the threshold of salt, sweet and olfactory senses in their study groups, which included BMS, compared to the normal controls, and proposed a central neuroplastic phenomenon in BMS. In our study, patients in both the groups reported no statistically significant differences in the changes in the sense of smell either before or after the onset of their current problem (Table 9). However, these results were completely subjective and no objective measures and/or scales were used to assess the smell dysfunction.

From our results, we observed that although BMS is considered to be a neuropathic phenomenon by many researchers, it showed some features that were not consistent with the other neuropathic conditions in the mouth. These features were→ bilateral involvement in BMS

compared to the unilateral involvement in other neuropathies; effects of eating/chewing and food(s) on the BMS symptoms severity etc. These findings suggest that the BMS may not be of neuropathic origin, but might have some other unknown mechanism involved in its onset. However, further studies with bigger sample size are required to elaborate this concept.

Conclusions

From our study, we were able to identify questions that could help differentiate BMS from other chronic oral neuropathic pain conditions and thus help in the diagnosis of these conditions (Table 10).

Table 10: Differences Between BMS And The Other Neuropathic Conditions In The Mouth – From The Responses To The Questions In The Questionnaire

BMS	Chronic oral neuropathic pain
Complain of both burning and pain	Complain mostly of pain
Usually bilateral, involving tongue and anterior hard palate	Mostly unilateral, involving gums and hard palate
Changes in severity and worst in the evening	Changes in severity and worst during the day and in the evening
Spontaneous/idiopathic onset	Onset was associated with dental treatment(s)
Eating and chewing – made the symptoms better	Eating and chewing – made the symptoms worse
Salty and spicy foods – made the symptoms worse	No effect of food(s) on the symptoms
Dental procedures – no change in the symptoms	Dental procedures – made the symptoms worse
Associated with the presence of 'feeling of dry mouth', which became worse since the onset	Not associated with the presence of 'feeling of dry mouth'
Decreased sense of taste since the onset	Mixed decrease and increase of sense of taste since the onset

However, we were not able to differentiate primary BMS from the secondary using this questionnaire as all the patients included in the Group1 had a diagnosis of primary BMS. Further

studies with a larger sample size and including both the primary and the secondary BMS patients are required to evaluate whether this questionnaire can be used to differentiate primary and secondary BMS patients. Also, evaluating the efficacy of this questionnaire in other chronic pain conditions, such as myo-fascial pain dysfunction, is indicated.

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