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4 **Burning mouth syndrome and associated factors: a retrospective study of 736 patients**

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7 **Síndrome de boca ardiente y factores asociados: estudio retrospectivo de 736 pacientes**

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4 **Abstract**  
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8 **Background and objective.** Burning mouth syndrome (BMS) can be defined as burning pain or  
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dysesthesia on the tongue and/or other sites of the oral mucosa without a causative identifiable lesion. The discomfort is usually of daily recurrence, with a higher incidence among people aged 50 to 60 years, affecting mostly the female gender and diminishing their quality of life. The aim of this study was to evaluate the association between several pathogenic factors and burning mouth syndrome. **Patients and methods.** 736 medical records of patients diagnosed of burning mouth syndrome (BMS) and 132 clinical histories for the control group were studied retrospectively. The protocol included: gender, age, type of oral discomfort and other variables. **Results.** Analysis of the association between related factors and BMS diagnosis revealed that only 3 factors showed a statistically significant association ( $p = 0.0001$ ): triggers (emotional factors, dental treatments), parafunctional habits, and oral hygiene. There was no statistically significant association between gender ( $p = 0.440$ ), substance abuse ( $p = 0.089$ ), systemic pathology ( $p = 0.099$ ) and BMS. **Conclusions.** Parafunctional habits like bruxism and abnormal movements of tongue and lips can explain the BMS main symptomatology. Psychological aspects and systemic factors should be always considered. As a multifactorial disorder, the treatment of BMS should be executed in a holistic way.

**Keywords:** Anxiety; Bruxism; Burning mouth; Depression; Pain; Syndrome

## Resumen

**Antecedentes y objetivo.** El síndrome de boca ardiente puede definirse como ardor o disestesia en la lengua y/u otras áreas de la mucosa oral, en ausencia de lesiones que puedan justificarlo. Estas molestias suelen recurrir diariamente, con mayor incidencia en pacientes de edades entre 50 y 60 años; predominan en el sexo femenino y provocan un deterioro de la calidad de vida. El objetivo de este estudio fue evaluar la asociación entre diversos factores patogénicos y el síndrome de boca ardiente. **Pacientes y métodos.** Se estudiaron de forma retrospectiva 736 historias clínicas de pacientes diagnosticados con síndrome de boca ardiente (SBA) y 132 historias clínicas de pacientes control. El protocolo incluyó: género, edad, tipo de molestia oral y otras variables. **Resultados.** El análisis de la asociación entre diversos factores y el diagnóstico de SBA mostró significación estadística ( $p = 0.0001$ ) en solo 3 de ellos: factores desencadenantes (de orden emocional, tratamientos odontológicos), hábitos parafuncionales e higiene oral. No se encontraron diferencias significativas entre el género ( $p = 0.440$ ), abuso de sustancias ( $p = 0.089$ ), patología sistémica ( $p = 0.099$ ) y SBA. **Conclusiones.** Los hábitos parafuncionales como el bruxismo y los movimientos anormales de la lengua y labios pueden explicar la sintomatología del SBA. Hay que tener en cuenta siempre los aspectos psicológicos y los factores sistémicos. Como alteración de carácter multifactorial que es, el tratamiento del SBA debe contemplarse de manera holística.

**Palabras claves:** Ansiedad; Bruxismo; Ardor bucal; Depresión; Dolor; Síndrome.

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4 **Introduction**  
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8 Burning mouth syndrome (BMS) is mostly expressed as a “burning or stinging sensation on the  
9 oral mucosa”, “oral dysesthesia”, “burning pain on the tongue” and so on. Without a causative  
10 identifiable lesion, the discomfort is usually of daily recurrence, although periods of no pain  
11 during the day are reported. It occurs mostly in females, affecting their quality of life<sup>1-4</sup>.  
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19 The International Association for the Study of Pain (IASP) defines BMS as burning pain or  
20 dysesthesia on the tongue and/or other sites of the oral mucosa, without any clinical or laboratory  
21 data. This syndrome has been classified in primary and secondary. In the primary form (essential  
22 or idiopathic), the burning sensation is not accompanied by clinical or analytical alterations; in  
23 the secondary form, lesions are present, with laboratory abnormalities, systemic diseases,  
24 psychological alterations, or consumption of specific medicines<sup>5</sup>. Lamey and Lewis (1989)  
25 proposed three clinical types based on the diurnal variation of the symptoms. The discomfort  
26 tends to be chronic, but spontaneous periods of remission are also common<sup>3</sup>. The typical patient  
27 with BMS is a menopausal woman with systemic diseases, burning mouth sensation on the  
28 tongue, taste alterations and dry mouth, without clinical lesion<sup>7</sup>.  
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45 Prevalence ranges between 0.7% and 5.1% in general population<sup>1,8</sup>, and 33% in risk groups<sup>1</sup>.  
46 Incidence is higher among people aged 50 to 60 years, with a ratio women/men between 3:1<sup>8</sup> and  
47 9:1<sup>1</sup>. This difference has been related to biological, psychological, and social factors<sup>9-12</sup>. The  
48 psychological component in BMS is supported by studies that report higher levels of depression  
49 and anxiety in patients with BMS compared to control groups<sup>12</sup>. In a study performed on 30  
50 patients with BMS a significantly association was found between taste alteration (metallic or  
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4 acidic taste) and depression<sup>13</sup>. Other studies showed that depression and anxiety were present in  
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6 50% of cases with BMS<sup>1,14</sup> and 67.1% of patients with this syndrome were found to suffer poor  
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8 sleep quality<sup>10</sup>. An association of openness personality trait with stress-related salivary  
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10 biomarkers has been related to BMS<sup>15</sup>. In recent years, new evidence seems to link BMS with  
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12 peripheral and neuropathic disturbances<sup>11,16</sup>. Menopausal hormone reduction has also been  
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14 linked to BMS<sup>2,3,9</sup>. Among the reported systemic factors associated with this syndrome are:  
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16 diabetes mellitus<sup>17</sup>, gastrointestinal reflux<sup>18</sup>, nutritional deficiencies<sup>17</sup>, hormonal changes<sup>9</sup>, and  
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18 some adverse effects of drugs<sup>17</sup>. Local factors and clinical conditions found in these patients  
19  
20 include geographic tongue, candidiasis, parafunctional habits, hyposalivation<sup>17</sup>, as well as  
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22 changes in the saliva composition, contact allergies<sup>19</sup> and dental treatments (prosthesis, implants,  
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24 teeth extractions)<sup>20</sup>.

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32 Management of BMS should be focused against the etiopathogenic factors, based on preventing  
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34 the causes of oral irritation. However, in some patients etiological factors are not easy to identify,  
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36 in that case BMS is considered to be idiopathic<sup>2,11,16</sup>. Several patients report improvement with  
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38 cold beverages, soft food and/or recreational activities<sup>4</sup>. The use of pharmacological treatment,  
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40 particularly topic clonazepam can also help to ameliorate the symptoms.<sup>21</sup> Psychological  
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42 support does usually help<sup>12</sup>.

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48 Differential diagnosis of BMS includes: candidiasis, oral lichen planus, geographic tongue,  
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50 contact allergic stomatitis, and xerostomia. Systemic diseases such as Sjögren syndrome and  
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52 other forms of dry mouth<sup>22</sup>, vitamin and mineral deficiencies<sup>23</sup>, uncontrolled diabetes and  
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54 hematological diseases<sup>24</sup>, should also be ruled out. If any of these are the causal factors, their  
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4 treatment should resolve the burning sensation. For idiopathic cases, several treatments have  
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6 been proposed to improve BMS, with variable results<sup>2,14,21,25</sup>.  
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10 Parafunctional habits like bruxism and abnormal movements of tongue and lips seem to play a  
11  
12 significant role in the pathogenesis of BMS<sup>7,25-27</sup>. Since the etiology of BMS is multifactorial,  
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14 the main objective of this study was to evaluate the association between several pathogenic  
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16 factors and the semiology of BMS.  
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### 19 20 21 **Patients and methods** 22

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24 736 medical records of patients diagnosed of BMS and 132 clinical histories for the control  
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26 group were studied retrospectively. Diagnosis was established by three experts in oral medicine.  
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28 The protocol included: gender, age, kind of pain or dysesthesia and time span of the burning  
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30 sensation. Other variables considered were: location and intensity of oral discomfort, triggers  
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32 (like recent dental treatment or emotional factors), parafunctional habits (like bruxism,  
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34 *morsicatio* and other repetitive movements of tongue, lips or other oral structures), systemic  
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36 pathology, oral hygiene, substance abuse (alcohol, tobacco, etc.), and type of treatment (Table 1).  
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38 All patients diagnosed by BMS were visited during the last 25 years. The application form was  
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40 approved by the Ethical Committee of the Dental Hospital, University of Barcelona.  
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### 47 *Ethical aspects* 48

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50 To maintain the patient confidentiality, recommendations of the Spanish Organic Law 15/1999  
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52 of December 13 on the Protection of Personal Data were followed. All participants were  
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54 identified by a code only known by the researchers.  
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4 *Inclusion criteria*  
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8 Patients of any gender and age suffering from burning mouth sensation and diagnosed of any  
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10 type of BMS were included. Patients with burning mouth sensation attributable to other causes  
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12 (oral candidiasis, geographic tongue, oral lichen planus) were excluded.  
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16 *Control group*  
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19 The BMS group of patients was compared with a control group consisting of subjects who did  
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21 not experience a burning sensation or discomfort in the mouth. These subjects were unselected  
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23 consecutive patients attending the dental clinic during the last year. The gender and age  
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25 distributions of the control group were similar to those of the BMS group.  
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30 *Statistical analysis*  
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33 The data were analyzed with the SPSS Statistics software package (ver. 20.0, IBM), and  $p \leq 0.05$   
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35 was required for statistical significance.  
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39 The normality of the distribution of continuous variables (age and time of duration) was tested  
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41 by means of the Kolmogorov-Smirnov test. To describe the incidence of the discrete variables,  
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43 the percentages for the combined sample and for gender-segregated samples were computed. To  
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45 investigate the association between diagnosed BMS and each factor considered as variable, a  
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47 multinomial logistic regression model was used, appropriate for dichotomous factors  
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49 (presence/absence). In addition to the multiple regression analysis conducted with all the factors  
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51 combined, the associations between each factor and BMS were analyzed separately by means of  
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53 the chi-square ( $\chi^2$ ) test.  
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## Results

The total sample included 736 patients with BMS and 132 control patients (Table 2). The ratio of women to men in the BMS group was 6:1, similar to the control group. The average age of the patients in the BMS group were 60.63 years for women and 59.07 years for men; in the control group, the corresponding ages were 55.11 and 55.48 years. Age was normally distributed in both groups ( $p = 0.608$  for the control group and  $p = 0.168$  for the BMS group). These results indicate that both samples were random and that there was no bias about age distribution. In contrast, the distribution of data for duration of BMS deviated substantially from normal, because of the variation between the onset of the symptoms and the diagnosis (Table 2).

### *Analysis of the factors associated with BMS*

Analysis of the associations between the factors and the diagnosis of BMS (Table 3, Analysis 1) revealed three significant associations ( $p = 0.0001$  in all three cases): triggers (TRIG), parafunctional habits (PARH), and oral hygiene (HYG). There was no association between gender and BMS ( $p = 0.440$ ), and therefore no differential affectation was observed by gender. Neither substance abuse (SABU,  $p = 0.089$ ) nor systemic pathology (SYSTP,  $p = 0.099$ ) were significant factors in the development of BMS, although the  $p$  values approached statistical significance ( $p < 0.10$ ).

To assess the specific weight of each factor, a second regression analysis (without the not significant factors of the previous one) was carried out. Note, however, that substance abuse and systemic pathology were included in the second analysis, because  $p$  was smaller than 0.10 for these factors. In this second analysis, triggers, parafunctional habits, and oral hygiene maintained their significance, and in addition, substance abuse showed a significant association with BMS ( $p$



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4 = 0.012). In contrast, systemic pathology remained not significant, and in fact, the  $p$  value  
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6 increased to 0.131 (Table 3, Analysis 2).  
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10 The results shown in Table 3 suggest an association between BMS and triggers, parafunctional  
11 habits, hygiene, and substance abuse (which is related to hygiene, usual less oral hygiene in  
12 smokers).  
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18 Finally, associations between factors (Table 4) were analyzed by means of contingency tables of  
19 differences, and the results showed that diagnosis of BMS was clearly associated with triggers,  
20 parafunctional habits, and hygiene, as well as with systemic pathology. This result suggests that  
21 systemic pathologies may have significant weight in BMS, despite the fact that the initial logistic  
22 regression analysis did not show a significant association ( $p > 0.05$ ). In this analysis, substance  
23 abuse was not significantly associated with the definitive diagnosis of BMS. With respect to the  
24 association between the other factors, all of them proved to be significantly associated ( $p \leq$   
25 0.035). This result suggests that BMS is multifactorial.  
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## 38 **Discussion**

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42 The results suggest that BMS is associated with various factors and is more frequent among  
43 females than among males (6:1), in agreement with previous reports<sup>1,25,28</sup>. Hormonal status may  
44 be involved in the greater prevalence in women, perhaps by modulating other factors in some  
45 way<sup>2</sup>. The average age of patients in the BMS group was 60.4 years, (range, 22–97 years).  
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47 Middle-aged and elderly patients tend to have multiple systemic pathologies and consequently  
48 tend to be subjected to several treatments, most of them causing xerostomia. Habitual smoking  
49 (tobacco, marijuana) also lead to local dryness and worsen the clinical condition of the  
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4 syndrome<sup>7</sup>. Dry mouth in combination with some triggers (psychological–anxiety, depression;  
5 dental treatments; poor oral hygiene; substance abuse; etc.)<sup>12</sup>, tend to promote some  
6 parafunctional habits like bruxism, repetitive swallowing, and diverse movements of tongue and  
7 lips<sup>7</sup>. Patients with BMS exhibit significantly more symptoms of depression and anxiety  
8 compared with healthy subjects<sup>10</sup>; this may explain the parafunctional habits and BMS  
9 association found in our study.  
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20 The variables “parafunctional habits”, “triggers”, “poor oral hygiene”, and, to a lesser extent,  
21 “substance abuse” and “systemic pathology” were clearly associated with BMS. Parafunctional  
22 habits have repercussions for the entire orofacial area. Bruxism can lead to dental and  
23 periodontal hypersensitivity. Corsalini et al. found in their study of 44 patients with BMS that  
24 72.2% showed parafunctional habits; especially night bruxism was observed in twenty-eight  
25 cases, clenching in ten cases, biting of lips and cheeks in six cases<sup>29</sup>. *Morsicatio* of the cheek or  
26 lip’s mucosa, tongue thrusting against teeth or prosthesis and other similar habits, can sometimes  
27 be performed continuously or intermittently generating local discomfort that involves teeth, oral  
28 mucosa, joints, and muscles. Parafunctional habits (related to tongue and lips) often coincide  
29 with poor oral hygiene (presence of plaque or calculus). The repetitive movement of tongue and  
30 lips causes tissue irritation; this can alter the perception of taste<sup>13</sup>, sometimes transmitted to the  
31 brain as distorted information of the peripheral stimulus (burning sensation)<sup>7</sup>.  
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50 Probably, the stress conditions associated to BMS could explain in these patients the onset of  
51 parafunctional habits<sup>29</sup>. Trigger of symptoms can often be of emotional kind (serious illness,  
52 death of a relative, problems at work), and they are also frequently associated to a recent dental  
53 treatment. The patient usually links the trigger to the symptoms. In a study performed on 75  
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4 patients with BMS, the most frequent trigger reported was stressful life events (45%) and an  
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6 antecedent dental procedure was present in 20% of the cases<sup>30</sup>.  
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10 In conclusion, the etiology of BMS is not fully known, making its diagnosis a challenging  
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12 process; several factors are associated with this pathology, what does justify a multifactorial  
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14 approach and treatment. BMS management must always include the psychological aspects; many  
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16 times the patient's externalization of the complaint can help them feel reassured. Systemic  
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18 associated factors like xerostomia, dehydration, or underlying nutritional deficiencies should  
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20 always be treated. Local factors like oral hygiene, elimination of local irritants (rinses,  
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22 toothpastes), and parafunctional habits should be controlled (a lower splint may be helpful).  
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24 Sometimes, the use of pharmacological treatment such as topical clonazepam can also help to  
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26 ameliorate the symptoms.  
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### 37 **References**

- 38 1. Rodríguez de Rivera Campillo M, López López J, Chimenos Küstner E, Sabater Recolons  
39 M. Estudio de una muestra de pacientes con síndrome de boca ardiente. Av  
40 Odontoestomatol. 2007;23:141–51.
- 41 2. Spanemberg JC, Cherubini K, de Figueiredo MAZ, Yurgel LS, Salum FG. Aetiology and  
42 therapeutics of burning mouth syndrome: an update. Gerodontology. 2012;29:84–9.
- 43 3. Gurvits GE, Tan A. Burning mouth syndrome. World J Gastroenterol. 2013;19:665–72.
- 44 4. Zakrzewska JM. Multi-dimensionality of chronic pain of the oral cavity and face. J  
45 Headache Pain. 2013;14:37.
- 46 5. Nasri-Heir C. Burning mouth syndrome. Alpha Omegan. 2012;105(3-4):76–81.
- 47 6. Lamey PJ, Lewis MA. Oral medicine in practice: burning mouth syndrome. Br Dent J.  
48  
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57  
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4 1989;167:197–200.  
5  
6  
7 7. Chimenos-Küstner E, Arcos-Guerra C, Marques-Soares MS. [Burning mouth syndrome:  
8 diagnostic and therapeutic keys]. *Med Clin (Barc)*. 2014;142:370–4.  
9  
10 8. López-Jornet P, Camacho-Alonso F, Andujar-Mateos P, Sánchez-Siles M, Gómez-García  
11 F. Burning mouth syndrome: an update. *Med Oral Patol Oral Cir Bucal*. 2010;15:e562–8.  
12  
13 9. Rodríguez-Cerdeira C, Sanchez-Blanco E. Treatment of burning mouth syndrome with  
14 amisulpride. *J Clin Med Res*. 2012;4:167–71.  
15  
16  
17 10. Lopez-Jornet P, Lucero-Berdugo M, Castillo-Felipe C, Zamora Lavella C, Ferrandez-  
18 Pujante A, Pons-Fuster A. Assessment of self-reported sleep disturbance and  
19 psychological status in patients with burning mouth syndrome. *J Eur Acad Dermatol*  
20 *Venereol*. 2015;29:1285–90.  
21  
22  
23 11. Heo J-Y, Ok S-M, Ahn Y-W, Ko M-Y, Jeong S-H. The application of neuropathic pain  
24 questionnaires in burning mouth syndrome patients. *J Oral Facial Pain Headache*.  
25 2015;29:177–82.  
26  
27  
28 12. Suresh K, Ganiger C, Ahammed YR, Kumar MD, Pramod R, Nayak A, et al. Psychosocial  
29 characteristics of oromucosal diseases in psychiatric patients: Observational study from  
30 Indian dental college. *N Am J Med Sci*. 2014;6:570.  
31  
32  
33 13. Davies SJC, Underhill HC, Abdel-Karim A, Christmas DM, Bolea-Alamanac BM,  
34 Potokar J, et al. Individual oral symptoms in burning mouth syndrome may be associated  
35 differentially with depression and anxiety. *Acta Odontol Scand*. 2016;74:155–60.  
36  
37  
38 14. Bakhtiari S, Khalighi HR, Azimi S, Alavi K, Ayoobi Valoogardi H, Namazi Z.  
39 Correlation between Burning Mouth Syndrome and Anxiety in the Elderly Inmates of  
40 Sanitaria in Tehran. *J Dent Res Dent Clin Dent Prospects*. 2010;4:37–41.  
41  
42  
43 15. de Souza FTA, Kummer A, Silva ML V, Amaral TMP, Abdo EN, Abreu MHNG, et al.  
44 The association of openness personality trait with stress-related salivary biomarkers in  
45 burning mouth syndrome. *Neuroimmunomodulation*. 2015;22:250–5.  
46  
47  
48 16. Silvestre FJ, Silvestre-Rangil J, López-Jornet P. Burning mouth syndrome: a review and  
49 update. *Rev Neurol*. 2015;60:457–63.  
50  
51  
52 17. Spanemberg JC, Rodríguez de Rivera Campillo E, Jané Salas E, López López J. Burning  
53 Mouth Syndrome: update. *Oral Health Dent Manag*. 2014;13:418–24.  
54  
55  
56 18. Silvestre FJ, Silvestre-Rangil J, Tamarit-Santafé C, Bautista D. Application of a capsaicin  
57 rinse in the treatment of burning mouth syndrome. *Med Oral Patol Oral Cir Bucal*.  
58 2012;17:e1–4.  
59  
60  
61  
62  
63  
64  
65

19. López-Jornet P, Juan H, Alvaro P-F. Mineral and trace element analysis of saliva from patients with BMS: a cross-sectional prospective controlled clinical study. *J Oral Pathol Med.* 2014;43:111–6.
20. Marino R, Capaccio P, Pignataro L, Spadari F. Burning mouth syndrome: the role of contact hypersensitivity. *Oral Dis.* 2009;15:255–8.
21. Rodríguez de Rivera Campillo E, López-López J, Chimenos-Küstner E. Response to topical clonazepam in patients with burning mouth syndrome: a clinical study. *Bull Group Int Rech Sci Stomatol Odontol.* 2010;49:19–29.
22. Chimenos-Kustner E, Marques-Soares MS. Burning mouth and saliva. *Med Oral.* 2002;7:244–53.
23. Soares MSM, Chimenos-Küstner E, Subirá-Pifarrè C, Rodríguez de Rivera-Campillo ME, López-López J. Association of burning mouth syndrome with xerostomia and medicines. *Med Oral Patol Oral Cir Bucal.* 2005;10:301–8.
24. Salort-Llorca C, Mínguez-Serra MP, Silvestre FJ. Drug-induced burning mouth syndrome: a new etiological diagnosis. *Med Oral Patol Oral Cir Bucal.* 2008;13:E167–70.
25. Rodriguez-de Rivera-Campillo E, Lopez-Lopez J. Evaluation of the response to treatment and clinical evolution in patients with burning mouth syndrome. *Med Oral Patol Oral Cir Bucal.* 2013;18:e403–10.
26. Paterson AJ, Lamb AB, Clifford TJ, Lamey PJ. Burning mouth syndrome: the relationship between the HAD scale and parafunctional habits. *J Oral Pathol Med.* 1995;24:289–92.
27. Lamey PJ. Burning mouth syndrome. *Dermatol Clin.* 1996;14:339–54.
28. López-Jornet P, Camacho-Alonso F, Molino-Pagan D. Prospective, randomized, double-blind, clinical evaluation of Aloe vera *Barbadosis*, applied in combination with a tongue protector to treat burning mouth syndrome. *J Oral Pathol Med.* 2013;42:295–301.
29. Corsalini M, Di Venere D, Pettini F, Lauritano D, Petruzzi M. Temporomandibular disorders in burning mouth syndrome patients: an observational study. *Int J Med Sci.* 2013;10:1784–9.
30. Adamo D, Celentano A, Ruoppo E, Cucciniello C, Pecoraro G, Aria M, et al. The Relationship Between Sociodemographic Characteristics and Clinical Features in Burning Mouth Syndrome. *Pain Med.* 2015;16:2171–9.

**Table 1.** Analyzed variables and factors considered for their association with burning mouth syndrome.

<b>Variable or factor</b>	<b>Description of discrete values</b>
Reason for consultation	BURNING MOUTH (or its variations, e.g., stinging, sour taste, sandy feeling) NO BURNING
Type of discomfort	ONLY BURNING BURNING + OTHER (e.g., dysgeusia, dryness)
Location	TONGUE + OTHER (e.g., lips, palate, gums) NOT ON TONGUE
Pain intensity (analog scale)	≤5 >5
Triggers	PRESENT (emotional triggers, recent dental treatments) ABSENT
Parafunctional habits	PRESENT (e.g., dental, lingual, muscular, mucosa) ABSENT
Systemic pathology	PRESENT (associated with medication) ABSENT (or does not take medication)
Oral hygiene	GOOD AVERAGE OR POOR (presence of bacterial plaque, calculus)
Dietary habits	GOOD (balanced diet, good hydration, i.e., >2 L of liquid/day) BAD (inappropriate diet, poor hydration)
Substance abuse	PRESENT (e.g., tobacco, alcohol, marijuana) ABSENT
Local factors	PRESENT (maladjusted prosthesis, sharp teeth or filling edges, etc.) ABSENT
Existing treatment	CONSERVATIVE (hydration, saliva substitutes, hygiene, balanced diet) MEDICINE (e.g., clonazepam, antidepressants, sedatives)
Definitive diagnosis	BMS no BMS or OTHER pathologies

**Table 2.** Distribution by gender and age of the BMS and control groups.

	BMS ( <i>n</i> = 736)		Control ( <i>n</i> = 132)	
Age (years)	$x = 60.41$ $SD = 13.38$ range = 22–97 $z = 1.112$ $p = 0.168$	Women, <i>n</i> = 630 $x = 60.63$ $SD = 13.25$ $z = 0.961$ $p = 0.314$	$x = 55.18$ $SD = 14.89$ range = 24–91 $z = 0.762$ $p = 0.608$	Women, <i>N</i> = 107 $x = 55.11$ $SD = 14.64$ $z = 0.628$ $p = 0.826$
		Men, <i>n</i> = 106 $x = 59.07$ $SD = 14.14$ $z = 0.632$ $p = 0.819$		Men, <i>N</i> = 25 $x = 55.48$ $SD = 16.22$ $z = 0.702$ $p = 0.709$
Time of evolution (months)	$x = 21.19$ $SD = 39.77$ range = 0.25–600 $z = 8.186$ $p = \mathbf{0.000}$	Women, <i>N</i> = 630 $x = 21.17$ $SD = 39.91$ $z = 7.577$ $p = \mathbf{0.000}$		
		Men, <i>N</i> = 106 $x = 21.31$ $SD = 39.06$ $z = 3.214$ $p = \mathbf{0.000}$		

Abbreviations: *x*, mean value; SD, standard deviation; *z*, Kolmogorov-Smirnov statistic for normality of the analyzed variable; *p*, significance of the Kolmogorov-Smirnov *z* test (if *p* < 0.05, the distribution of the variable was considered to deviate significantly from normal). Significant *p* values are shown in bold.

**Table 3.** Logistic regression analyses 1 and 2 of associations between main factors involved in BMS development.

	Analysis 1			Analysis 2		
	$-2 \log v$	$\chi^2$	$p$	$-2 \log v$	$\chi^2$	$p$
Intercept	245.403			133.368		
GEN	245.998	0.595	0.440			
TRIG	266.507	21.104	<b>0.000</b>	157.254	23.886	<b>0.000</b>
PARH	269.971	24.568	<b>0.000</b>	167.211	33.843	<b>0.000</b>
SYSTP	248.124	2.721	0.099	135.650	2.282	0.131
HYG	269.679	24.275	<b>0.000</b>	157.659	24.291	<b>0.000</b>
DIET	245.622	0.219	0.640			
SABU	248.302	2.899	0.089	139.721	6.353	<b>0.012</b>
LOCF	246.04	0.637	0.425			

Abbreviations: GEN, gender; TRIG, triggers; PARH, parafunctional habits; SYSTP, systemic pathology; HYG, oral hygiene; DIET, dietary factors; SABU, substance abuse; LOCF, local factors.  $-2 \log v$  = statistic of the reliability ( $v$ ) of the logistic regressions;  $\chi^2$  = chi-square statistic for the association between the dependent variable (BMS) and the factors considered. Analysis 1 included all the analyzed factors, whereas analysis 2 included only the factors that were significant (or approached significance) in analysis 1 ( $p < 0.100$ ). Significant  $p$  values are shown in bold.



**Table 4.**  $\chi^2$  and  $p$  values for associations between BMS and the factors considered.

	BMS
TRIG	$\chi^2 = 57.369$ $p = 0.000$
PARH	$\chi^2 = 34.841$ $p = 0.000$
HYG	$\chi^2 = 40.249$ $p = 0.000$
SABU	$\chi^2 = 0.088$ $p = 0.993$
SYSTP	$\chi^2 = 8.764$ $p = 0.033$

Abbreviations: BMS, positive definitive diagnosis of Burning Mouth Syndrome; TRIG, triggers; PARH, parafunctional habits; HYG, oral hygiene; SABU, substance abuse; SYSTP, systemic pathology.