Burning Mouth Syndrome: A Review

SMA SADAT[a], NM CHOWDHURY[b], RBA BATEN[c]

Summary:

Burning Mouth Syndrome (BMS) is characterized by chronic oro-facial pain in the absence of specific oral lesions & clinically apparent mucosal alterations. It is more commonly observed in middle aged patients & postmenopausal women. It often affects tongue, cheek, lip, hard & soft palate. Usually symptoms are better observed in morning, worsen during the day and typically subside at night. The condition is multifactorial origin, often idiopathic and its etiopathogenesis remain largely enigmatic. Associated medical conditions may include neurologic and metabolic disorder, gastrointestinal, urogenital as well as drug reactions. BMS are of two types, primary & secondary. Primary BMS is essential or idiopathic where secondary BMS is caused by local, systemic and/or psychological factors. Clinical diagnosis depends on the careful history taking, physical examinations and laboratory findings. Vitamin, Zinc or Hormone replacement therapy has been found to be effective with deficiency of the corresponding factors. The drug therapy with alpha-lipoic acid, capsaicin, clonazepam, benzodiazepines, tricyclic antidepressants, anticonvulsants may be effective in symptomatic treatment of BMS. But the treatment is still unsatisfactory and there is no definitive cure.

Keywords: Burning Mouth Syndrome, Glossodynia, Review, Stomatodynia

(J Bangladesh Coll Phys Surg 2016; 34: 151-159)

Introduction:

The international association for the study of pain (IASP) has identified BMS as a "Distinctive nosological entity" characterized by "unremitting oral burning or similar pain in the absence of detectable oral mucosa change"[1]. Burning mouth syndrome is typically described by the patient as burning, stinging and/or itching of the oral cavity in the absence of any organic disease. It lasts at least for 4-6 months duration and typically located on the tongue, particularly in the tip and lateral borders, lips, hard & soft palate, alveolar ridges with the buccal mucosa and floor of the mouth being less frequently involved [2-5]. BMS mainly affects middle aged or old women with hormonal changes or psychological disorders[6-8]. BMS can be accompanied by Dysgeusia (distortion in sense of taste), Glossodynia (painful tongue), Glossopyrosis (burning tongue) & Xerostomia (dry mouth). However, careful history taking, physical examination and appropriate laboratory testing can be effective in the proper treatment planning of BMS. BMS is usually treated through a multidisciplinary approach by antidepressants, analgesics, antiepileptics, antifungals, antibacterials, sialagogues, antihistamines, anxiolytic, antipsychotics and vitamin, minerals and hormonal replacements. Moreover patients need psychological support for the long term rehabilitation.

Discussion:

Epidemiology

BMS typically observed in middle age/ old women with an age range of 38-78 years[3,9-11]. The condition is extremely rare in patients under 30 years and never been reported in children and adolescence[12]. BMS has a significant female predilection with the ratio is about 7:1[8-11,13]. These differences between genders may be explained by biological, psychological & sociocultural factors. Prevalences of BMS reported from international studies ranges from 0.7%- 4.5%[11,14-18]. Epidemiological studies revealed that this condition is more common in pre and postmenopausal women which ranges upto 12-18%[19].

a. Dr. SM Anwar Sadat, Lecturer, Dept. of Oral & Maxillofacial Surgery, Dhaka Dental College, Dhaka, Bangladesh.

b. Dr. Naim Mahmud Chowdhury, Lecturer, Dept. of Oral & Maxillofacial Surgery, Chittagong International Dental College, Chittagong, Bangladesh.

c. Dr. Redwan Bin Abdul Baten, Assistant Dental Surgeon, Upozilla Health Complex, Nabinagar, Brahmanbaria, Bangladesh.

Address of Correspondence: Dr. S. M. Anwar Sadat, Lecturer, Dept. of Oral & Maxillofacial Surgery, Dhaka Dental College, Dhaka, Bangladesh. Contact No. +880 1711156023, E-mail: an_sadat@yahoo.com

Received: 2 November, 2015 **Accepted:** 25 February, 2016

Recent analysis showed an increase likelihood of gastrointestinal & urogenital disease in patient with BMS. Patient with BMS had a statistically higher intake of medications for gastric disease[2].

Pathophysiology:

Though the pathophysiology of Burning Mouth Syndrome is not well understood, significant differences of thermal and nociception thresholds of patients with BMS are established in comparison to control subjects[5]. Thus a neuropathic mechanism for BMS is currently favored though the controversy remains exist between peripheral and central dysfunction. Central neuropathic mechanisms have been demonstrated following thermal stimulation of the nerve in patients with BMS. Patients with BMS show patterns of cerebral activity similar to those that appear in other neuropathic pain disorders, suggesting that the cerebral hypoactivity could be an important element in the pathogenesis of BMS[5].

Etiological factors

The exact etiology of BMS is unknown. Although there is no definitive cause of primary BMS, there are numerous potential secondary causes of the burning mouth syndrome. Several factors play an important role in the etiology of BMS. These are grossly classified to local, systemic and psychological factors [20]. The contributing factors may be physical, chemical or biological (some bacteria and fungi)[14]. The important factors are:

1. Mechanical factors: Poorly fitted oral or dental prosthesis that produce microtrauma or local erythema[21]
2. Parafunctional Habits: Tongue thrust, Bruxism, clenching, Continual rubbing over the teeth & prosthesis, buccal, labial, lingual biting & compulsive movements of the tongue[22]
3. Local allergic reactions: High levels of residual monomers, nylon, ascorbic acid, cinnamon, nicotinic acid, dental materials (zinc, cobalt, mercury and palladium). Sodium lauryl sulfate a detergent in toothpaste may also be involved in the development of dry mouth[18,23-25].
4. Nutritional abnormalities: Vitamin B_1, B_2, B_6, B_{12} as well as folic acid, pernicious anemia, iron deficiency anemia, Vitamin E and Vitamin C deficiencies [26,27]
5. Oral infections: Candidiasis, Infection caused by enterobacter, klebsiella& S. aureous [14,28,29]
6. Hormonal change: Dryness of mucosal membrane from age related reduction in estrogen & progesterone levels & increased frequency of psychological disorders of middle aged and elderly women, uncontrolled diabetes mellitus, gastro-oesophegial reflux, thyroid dysfunction[11,30]
7. Drugs: Antihistamine, Neuroleptics, anti-hypertensives principally those act on renin angiotensin system (captroplil, enalapril, lisinopril) & ACE inhibitors[8,31-33]
8. Psychiatric disorders: Anxiety, depression, personality disorder, cancerophobia, higher tandency to worry about health[34]
9. Salivary dysfunction: Xerostomia, salivary gland dysfunction, salivary component changes[3,7,8,25,35,36].
10. Autoimmune disease: Sjogren's syndrome, systemic lupus erythematosus, lichen planus [37]
11. Others: Loss of taste buds, depapillation of tongue, oral desquamation due to agechange, side effects of radiation or chemotheraphy, cranial nerve injury, parkinson's disease, trigeminal neuralgia, glossopharyngeal neuralgia, herpes simplex, herpes zoster, smoking[38,39]
12. Idiopathic factors

Classification of BMS

According to clinical symptoms BMS is classified to primary or essential/ idiopathic and secondary[40,41].

1. Primary or essential/ idiopathic: In primary BMS organic causes cannot be identified and peripheral or central neuropathological pathways are involved.
2. Secondary BMS: Result from local or systemic pathological conditions. Causes are local infection, autoimmune diseases of the oral mucosa (lichen planus), nutritional and vitamin deficiencies, glossitis, salivary disorders, allergies, irritation caused by reflux, dental-alveolar diseases, metabolic disorders, candidiasis, nerve damage, trauma, diabetes mellitus, gastrointestinal and urogenital diseases or administration of certain drugs.

According to pain pattern BMS is classified into three types[4,12,14,21,41]

1. Type-I (35%): Characterized by pain free awakening, worsening throughout the day, and receiving its peak intensity by evening. This type is usually associated with systemic disorders such as nutritional deficiencies, diabetes mellitus.
2. Type-II (55%): Characterized by continuous symptoms throughout the day but not at night. This type is usually associated with psychological disorders.
3. Type-III (10%): Characterized by intermittent symptoms with pain free episodes during the day. This type is usually associated allergic reactions.

Clinical features

The chief complain of BMS patient is oral burning. The symptom is described by individual patient as continuous & chronic discomfort, sudden or intermittent onset of pain. Pain is increased progressively during the day and pain is relieved by sleeping and eating foods (although some may worsen the pain)[27,39]. Patient may also describe the symptom as tingling, scalding, annoying, tender or numb filling of the oral mucosa. The pain is primarily bilateral and typically on the anterior 2/3 of the tongue (71-78%) followed by dorsal and lateral border of the tongue, anterior portion of hard palate, labial mucosa or gingiva with no identifiable precipitating factors except stress and other psychological factors[14-16,42]. To fulfill the diagnostic criteria for BMS, pain episode must occur continuously at least 4-6 months[1,43]. Acidic or spicy foods may increase burning symptoms[44]. BMS patient may suffer from headache & TMJ pain[45]. They often show easy fatiguability, sensitivity, anxiety, muscular tension and a tendency to be more concerned about their health. Sleep disturbance may also be present. 70% of BMS patient has persistent test disorders as bitter, metallic or both[3,8,46-48]. Xerostomia may be the complaints of approximately 46-67% of BMS patient[6,8,11]. Other symptoms include dysgeusia, sensory disturbance and sticky sensation, dysphagia, burning irritation of lingual papilla, pruritis, and intolerance to prosthesis[14,17]. Oral findings are erythema, geographic tongue, candidiasis, atrophic glossitis, lichen planus[49].

Diagnostic criteria

Taking a thorough and comprehensive history & laboratory findings are the key to diagnosis. Diagnosis of BMS is very much difficult because BMS is positively designed only by symptoms without signs or etiologies. The symptomatic traid rarely occurs simultaneously in one patient. Overlapping stomatitis may confuse the clinical presentation. However, some diagnostic work up include oral examination, salivary parameters, nutritional parameters, hormonal parameters, medication, parafunctional habits, contact allergies, psychological and psychosocial evaluation. There are various investigations that can be used to rule out secondary causes of BMS such as blood count which may reveal infections or anemia, blood level of iron, zinc, folic acid, vitamin B-complex, serum ferritin, fasting blood sugar, allergy testing, fungal or oral cultures, thyroid functions & serum autoantibodies[4,44,50,51]

Differential diagnosis of BMS

The BMS diagnosis may be confusing with stomatitis, atypical facial pain, atypical odontalgia, pemphigoid, pemphigus, denture design and tooth restoration failure, herpes simplex or herpes zoster, neoplastic lesions, trauma to lingual or mandibular nerve from dental surgery.

Treatment

Treatment of BMS patient varies in individual patient. A multidisciplinary approach is needed for the treatment of BMS. Primarily patients need psychological support. Patient must be informed about the nature of the condition. They should assured as the syndrome is common in middle aged & elderly individual and the syndrome is not any form of cancer. They should also inform that all the symptoms may not definitely disappear. The investigator should have a detailed review of patients personal, familiar, medical and dental histories and a careful interpretation of data obtained from various physical and laboratory investigations to identify the symptoms are primary or secondary. A lack of oral mucosal pathology is mandatory for the diagnosis of BMS. As the symptoms of primary BMS are idiopathic and its etiology is unknown, a variety of drug treatment is found beneficial in some research. Some drugs are used topically and some are systemically. Behavioral interaction is needed sometimes. Medications used for BMS include antidepressants, analgesics, antiepileptics,

Principal clinical features in different idiopathic oro facial pain conditions[4]:

	Atypical facial pain (bone)	Atypical odontalgia (tooth)	Burning mouth syndrome (mucosa)	Idiopathic facial arthromyalgia (muscle, TMJ)
Pain descriptors	Emotional, mechanical, burning	Varied	burning	Spontaneous or during function or voluntary movements
Intensity	Moderate to intense	Moderate to intense	Weak to intense	Weak to intense
Pattern	Continuous	Continuous with possible remission	Continuous	Continuous with remission
Localization	Initially unilateral then bilateral	Initially a single tooth then may spread	Bilateral, symmetrical	Unilateral or bilateral
Paroxysmal	No	No or little	No	No
Pain during sleep	No	No	Infrequent	Uncommon but disturbed sleep
Other associated signs/ symptoms	Bone cavity, osteoporosis	None	Dysgeusia, xerostomia, thirst	TMJ functional limitations, tenderness in masticatory/ TMJ palpation, TMJ sounds, bruxism, parafunction
Neurological signs	Dysesthesia, allodynia, paresthesia	Allodynia	Sensory, chemo-sensory anomalies	Allodynia (trigger point in myofacial pain)
Psychological profile	Frequently altered	Frequently altered	Frequently altered	Frequently altered

antifungals, antibacterials, sialagogues, antihistamines, anxiolytic, antipsychotics and vitamin, minerals and hormonal replacements. Topical application of capsaicin (0.02% cream 3-4 times daily) has been used as a desensitizing agent or analgesic for treatment of oral mucosal burn\\ing. But it is usually unaccepted by the patient due to its taste. Furthermore it causes an increase in the burning sensation at the beginning of the treatment[52]. Another topical drugs used are lidocaine, clonazepam, benzydamine, doxepin, lectoperoxidase. Clonazepam is the only topical theraphy studied in a double-blind randomized plaecbo controlled fashion. The topical application of clonazepam (by sucking a tablet of 1 gm) two or three times a day for 14 days treatment period provided reduced burning in two thirds of the patients studied[53]. The most commonly used local anesthetic agent lidocaine has not been shown as an effective treatment due to their short duration of analgesic action. Topical application of Aloe vera gel (0.5 ml three times a day) combined with tongue protector found to be effective[53]. Systemic drugs for BMS treatment include gabapentin, pregabalin, amitriptyline, nortriptyline, clonazepam, pramipexole and capsaicin. Results with gabapentin were found little or no effect on BMS treatment while positive results were obtained with pregabalin use. Systemic use of capsaicin (0.25% three times a day for one month) is found a significant reduction of pain intensity. It is not recommended for extended treatment as 32% of patients experience gastric pain after 4 weeks of treatment[54]. Systemic use of clonazepam (0.25 mg/day increasing to a maximum of 3 mg/day) has also been found better results. Combined topical and systemic use of clonazepam has found more effective[15]. Several studies suggest that alpha lipoic acid (200 mg three times a day) can improve the symptoms in BMS at two months. This improvement is maintained during the first year in 70% of the patient. In other studies show that the combination of psychotherapy (one hour session weekly for two months) and alpha lipoic acid (200 mg three times a day for two months) was significantly more effective than psychotherapy alone or alpha lipoic acid alone[55,56]. Secondary BMS is associated with causative factors. Laboratory findings are needed to identify the cause and treatment of BMS. Deficiencies of vitamin B-complex, folic acid, iron can be treated by supplemental use of these components. For the patients with zinc deficiency, zinc replacement therapy (14.1 mg per day for 6 months) has improved the condition [57]. The prevalence of oral discomfort is higher in peri-menopausal and post-menopausal women than in pre-menopausal women due to estrogen deficiency.

However, hormone replacement theraphy (conjugated estrogen for 21 days and medroxyprogesteron from day 12 through day 21) is effective in pain relief due to the presence of estrogen receptor on the oral mucosa[58]. BMS patient with psychological cause is treated by psychotherapy alone or combined with drug therapy. Although, variety of drugs are used for the treatment of BMS but the treatment is not satisfactory and there is no definitive cure. It is important to inform patients about the nature of the disease to understand their pathology.

Several drugs and therapies used for treatment of BMS

Author. date	Drug or therapy used	comments
Sun et al. 2013 **(59)**	Vitamin supplement treatment: Supplementation with vitamin BC capsules plus relatively high doses of corresponding deficient hematinics (vitamin B_{12}, folic acid and iron)	Approximately 44.4% of 399 patients with BMS show complete remission of all oral symptoms
Cho et al. 2010 **(57)**	Zinc replacement treatment: A zinc supplement (14.1 mg/day) for 74 (26.8%) BMS patients with zinc deficiency	Zinc replacement therapy for 6 months can lower the mean numerical pain scale from 8.1 to 4.1 compared with a mean decrease from 7.7 to 6.7 in a control group
Forabosco et al. 1992 **(58)**	Hormone replacement treatment: 27 post-menopausal patients with oral discomfort are treated with conjugated estrogens (premarin) 0.625 mg/day for 21 days plus medroxyprogesteronacetate (farlutal) 10 mg/day from day 12 through day 21 of the treatment cycle for three consecutive 21 day cycles	Hormone replacement therapy can relief the symptoms and improve oral cytologic features in 15 of 27 patients with oral symptoms. The relief of oral discomfort following hormone replacement therapy is due to the presence of estrogen receptors on the oral mucosa
Epstein and Marcoe. 1994 **(52)**	Topical capsaicin treatment: Capsaicin cream (0.025%) to the site of discomfort four times a day for at least 4 weeks	Topical capsaicin can be used as a desensitizing agent or an analgesic for treatment of oral mucosal burning
Gremeau-Richard et al. 2004 **(53)**	Topical clonazepam treatment: The patients are instructed to suck a tablet of 1 mg clonazepam with saliva at the oral pain sites for 3 mins and then to split. This protocol is repeated three times a day for 14 days	Clonazepam acts as an agonist of gamma-amino butyric acid (GABA) receptors. A greater reduction of pain score in clonazepam-treated patients than in placebo-treated patients suggests that the action of this drug is related to peripheral nervous system dysfunction in patients with BMS and the presence of GABA receptors in peripheral tissues
Sardella et al. 1999 **(60)**	Topical lidocaine benzydamine hydrochloride treatment: Lidocaine or 0.15% benzydamine hydrochloride as a mouthwash	Lidocaine is a local anesthetic agent and 0.15% benzydamine hydrochloride has anesthetic and anti-inflammatory effect. These two agents can lessen the pain and burning symptoms in patients with BMS. But the analgesic effect is of short duration.
Lopez-Jornet et al. 2012 **(61)**	Topical aloe vera treatment: Topical application of 0.5 ml aloe veragel at 70% to the sore areas of the tongue three times a day combined with a tongue protector.	This agent is effective in reducing tongue burning and pain
Petruzzi et al. 2004 **(54)**	Systemic capsaicin treatment: 0.25% capsaicin three times a day for 30 days	The drug can reduce the pain intensity. However its use is not recommended for extended treatment as 32% of patients experience gastric pain after 4 weeks of treatment.
Grushka et al. 1998 **(62)**	Systemic clonazepam treatment: 30 patients with BMS take an initial dose of 0.25 mg clonazepam daily with an increase in dose of 0.25 mg clonazepam on a weekly basis if symptoms continue	Approximately 70% of patients with BMS experience pain reduction with effects at low doses
Hackmann et al. 2012 **(63)**	Systemic clonazepam treatment: 0.5 mg clonazepam per day	The agent is effective for reducing pain and burning sensation

table continued

Author. date	Drug or therapy used	comments
Ko et al. 2012 **(64)**	Systemic clonazepam treatment: 100 patients with BMS are instructed to take 0.5 mg of clonazepam once or twice daily for 4 weeks	Psychological status, initial symptom severity and the presence of xerostomia and/ or taste disturbance can serve an outcome predictors of systemic clonazepam therapy for patients with BMS
Amos et al. 2011 **(65)**	Combined topical and systemic clonazepam therapy: 36 patients with BMS are asked to dissolve clonazepam tablet (0.5 mg tablet three times daily) orally before swallowing and are followed up over a 6 months period	About 80% of patients obtain more than a 50% reduction in pain over the treatment period and one-third of the patients have complete pain resolution.
Femiano et al. 2004 **(66)**	Systemic alpha lipoic acid treatment: 192 patients with BMS are treated with two hour psychotherapy alone weekly for two months, alpha lipoic acid (600 mg/day) alone for two months or combination therapy for two months	Patients with BMS receiving combination therapy for two months obtain more significant improvement of BMS symptoms than patients treated with psychotherapy alone for 2 months or alpha lipoic acid alone for 2 months.
Marino et al. 2010 **(67)**	Systemic treatment with capsaicin, alpha lipoic acid, lysozyme-lactoperoxidase (test drugs) and boric acid (control group) for 56 patients with BMS	A significant reduction in the symptoms scores of all patients with BMS who received the test drugs for a period of 60 days and at the end of the follow-up period (60 days after discontinuation) is found effective in the three test groups as a whole
Maina et al. 2002 **(68)**	Systemic treatment with amisulpride (50 mg/day) or selective serotonin inhibitors such as paroxetine (20 mg/day) and sertraline (50 mg/day) for 8 weeks	All three treatment regimens can result in a significant improvement of oral burning symptom from baseline to week 8. Amisulpride shows a shorter response latency and a better compliance than the other two drugs
Rodriguez-Cerdeira and Snchez-Blanco. 2012 **(69)**	Systemic amisulpride treatment: amisuplride (50 mg/day) for 24 weeks	A significant improvement of burning mouth symptoms is found from baseline to week 24. Amisulpride seems to be effective and well tolerated by the patients as a short term treatment
Yamazaki et al. 2009 **(70)**	Systemic paroxetine treatment: Paroxetine (10 or 20 mg/day with dosage increasing to a maximum of 30 mg/day to treat patient with BMS for 12 weeks	Approximately 80% of patients with BMS reported a reduction in symptoms with complete remission of pain being observed in 70% of patients by week 12
Bergdahl et al. 1995 **(71)**	Cognitive behavior therapy: Once a week for 12-15 weeks to treat patients with BMS	A decrease in pain intensity is observed immediately after therapy and in a follow-up of 6 months

Conclusion:

BMS is a painful condition interfering with patient's normal livelihood. Evaluation must be focused on ruling out all secondary causes of oral burning and treating the underlying etiology. New evidence for the neuropathic basis of the syndrome is emerging. There are no well-defined data and studies to formulate a consensus on this syndrome. Therefore research in this area undertaken according to a variety of approaches is needed for a clean definition, diagnostic criteria and to establish a proper treatment planning.

References:

1. Merskey H, Bugduk N, editors (1994). Classification of chronic pain. Descriptions of chronic pain syndromes and definitions of pain terms. In: Task on taxonomy. Seattle: IASP Press, p. 74.
2. Netto FO, Diniz IM, Grossmann SM, de Abreu MH, do Carmo MA, Aguiar MC. Risk factors in burning mouth syndrome: a case-control study based on patient records. ClinOral Investig2011; 15: 571-575.
3. Lamey PJ, Lamb AB. Prospective study of aetiological factors in burning mouth syndrome. Br Med J 1988; 296: 1243-1246
4. 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: 275– 91.
5. Lauria, G., Majorana, A, Borgna M, Lombardi, R, Penza P, Padovani A. et al. Trigeminal small-fiber sensory

neuropathy causes burning mouth syndrome. Pain 2005; 115:332–337.

6. Gorsky M, Silverman S Jr, Chinn H. Burning mouth syndrome: a review of 98 cases. J Oral Med 1987;42:7-9.
7. Gorsky M, Silverman S Jr, Chinn H. Clinical characteristics and management outcome in the burning mouth syndrome : An open study of 130 patients. Oral Surg Oral Med Oral Pathol 1991; 72:192-195.
8. Grushka M. Clinical features of burning mouth syndrome. Oral Surg Oral Med Oral Pathol 1987;63:30-36.
9. Basker RM, Sturdee DW, Davenport JC. Patients with burning mouths. A clinical investigation of causative factors, including the climacteric and diabetes. Br Dent J 1978; 145:9-16.
10. Tammiala-Salonen T, Hiidenkari T, Parvinen T. Burning mouth in a Finnish adult population. Community Dent Oral Epidemiol 1993;21:67-71.
11. Bergdahl M, Bergdahl J. Burning mouth syndrome: prevalence and associated factors. J Oral Pathol Med 1999; 28:350-354.
12. Grushka M, Epstein JB, Gorsky M. Burning mouth syndrome: differential diagnosis. Dermatol Ther. 2002;15:287-291.
13. Lipton JA, Ship JA, Larach-Robinson D. Estimated prevalence and distribution of reported orofacial pain in the United States. J Am Dent Assoc1993;124:115-121.
14. Klasser GD, Fischer DJ, Epstein JB. Burning mouth syndrome: recognition, understanding, and management. Oral Maxillofac Surg Clin North Am. 2008;20:255-71.
15. Brufau-Redondo C, Martín-Brufau R, Corbalán-Velez R, de Concepción- Salesa A. Burning mouth syndrome. Actas Dermosifiliogr. 2008;99:431-40.
16. Fedele S, Fricchione G, Porter SR, Mignogna MD. Burning mouth syndrome (stomatodynia). QJM. 2007;100:527-30.
17. Patton LL, Siegel MA, Benoliel R, De Laat A. Management of burning mouth syndrome: systematic review and management recommendations. Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2007;103 Suppl:S39.e1-13.
18. Lamey PJ, Lamb AB, Hughes A, Milligan KA, Forsyth A. Type 3 burning mouth syndrome: psychological and allergic aspects. J Oral Pathol Med. 1994;23:216-9.
19. Zakrzewska JM, Forssell H, GlennyAM. Interventions for the treatment of burning mouth syndrome. Cochrane Database Syst Rev. 2005;(1):CD002779.
20. Therapeutic options in idiopathic burning mouth syndrome: literature review. Int Arch Otorhinolaryngol. 2015;19(1):86-9.
21. Lopez-Jornet P, Camacho-Alonso F, Andujar-Mateos P, S_anchez-Siles M, G_omez-Garcia F. Burning mouth syndrome: an update. Med Oral Patol Oral Cir Bucal 2010; 15: e562–8.
22. 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;24:289-292.
23. Haustein UF. Burning mouth syndrome due to nicotinic acid esters and sorbic acid.Contact Dermatitis 1988; 19: 225-226.
24. Steele JC, Bruce AJ, Davis MD, Torgerson RR, Drage LA, Rogers RS. Clinically relevant patch test results in patients with burning mouth syndrome. Dermatitis 2012; 23: 61-70.
25. Jensen JL, Barkvoll P. Clinical implications of the dry mouth. Oral mucosal diseases. Ann N Y AcadSci1998; 842: 156-162.
26. Lehman JS, Bruce AJ, Rogers RS. Atrophic glossitis from Vitamin B12 deficiency: A case misdiagnosed as burning mouth disorder. Journal of Periodontology2006; 77(12), 2090–2092.
27. Shah, M. (2007). Burning mouth syndrome. In F. F. Ferri (Ed.), Ferri's clinical advisor 2007: Instant diagnosis and treatment (9th ed.). Philadelphia, PA: Mosby Elsevier.
28. Huang W, Rothe MJ, Grant-Kels JM. The burning mouth syndrome. J Am Acad Dermatol 1996; 34: 91-98.
29. Samaranayake LP, Lamb AB, Lamey PJ, MacFarlane TW. Oral carriage of Candida species and coliforms in patients with burning mouth syndrome. J Oral Pathol Med 1989; 18: 233-235.
30. Fischer MJ. Amine coupling through EDC/NHS: a practical approach. Methods Mol Biol 2010; 627: 55-73.
31. Klasser GD, Epstein JB, Villines D. Diagnostic dilemma: the enigma of an oral burning sensation. J Can Dent Assoc 2011; 77: b146.
32. Miziara ID, Filho BC, Oliveira R, Rodrigues dos Santos RM. Group psychotherapy: an additional approach to burning mouth syndrome. J Psychosom Res 2009; 67: 443-448.
33. Loeb LM, Naffah-Mazzacoratti MG, Porcionatto MA, Martins JR, Kouyoumdjian M, Weckx LM, Nader HB. Chondroitin sulfate and kallikrein in saliva: markers for glossodynia. IntImmunopharmacol 2008; 8: 1056-1058.]
34. de Souza FT, Teixeira AL, Amaral TM, dos Santos TP, Abreu MH, Silva TA, Kummer A. Psychiatric disorders in burning mouth syndrome. J Psychosom Res 2012; 72: 142-146 [PMID: 22281456]
35. Maresky LS, van der Bijl P, Gird I. Burning mouth syndrome. Evaluation of multiple variables among 85 patients. Oral Surg Oral Med Oral Pathol 1993;75: 303-307.

36. Grushka M, Sessle BJ. Burning mouth syndrome. Dent Clin North Am 1991; 35:171-184.

37. Grushka M, Ching V, Epstein J. Burning mouth syndrome. Adv Otorhinolaryngol 2006; 63: 278-287

38. Grushka M, Epstein JB, Gorsky M. Burning mouth syndrome.American Family Physician, 2002;65(4), 615–620.

39. Grushka M, Ching V, Epstein J. Burning mouth syndrome.Advances in Otorhinolaryngology 2006;, 63, 278–287.

40. Headache Classification Subcommittee of the International Headache Society. The International Classification of Headache Disorders: 2nd edition. Cephalalgia. 2004;24Suppl 1:9160.

41. Danhauer SC, Miller CS, Rhodus NL, Carlson CR. Impact of criteria-based diagnosis of burning mouth syndrome on treatment outcome. J Orofac Pain 2002;16:305-11.

42. Aravindhan R1, Vidyalakshmi S2, Kumar MS3, Satheesh C4, Balasubramanium AM5, Prasad VS2. Burning mouth syndrome: A review on its diagnostic and therapeutic approach. J Pharm Bioallied Sci. 2014 Jul;6(Suppl 1):S21-5.

43. Bergdahl J, Anneroth G. Burning mouth syndrome: literature review and model for research and management. J Oral Pathol Med 1993; 22:433-438.

44. Suarez P, Clark GT. Burning mouth syndrome: An update on diagnosis and treatment methods. Journal of the California Dental Association 2006; 34(8), 611–622.

45. Patton LL, Siegel MA, Benoliel R, De Laat A. Management of burning mouth syndrome: Systematic review and management recommendations. Oral Surgery, Oral Medicine, Oral Pathology, Oral Radiology, and Endodontics2007; 103: S39.e1–S39.e13.

46. Main DM, Basker RM. Patients complaining of a burning mouth. Further experience in clinical assessment and management .Br Dent J 1983; 154:206-211.

47. Eli I, Kleinhauz M, Baht R, Littner M. Antecedents of burning mouth syndrome (glossodynia)—recent life events vs. psychopathologic aspects. J Dent Res 1994; 73:567-572.

48. Ship JA, Grushka M, Lipton JA, Mott AE, Sessle BJ, Dionne RA. Burning mouth syndrome: an update. J Am Dent Assoc 1995;126:842-853.

49. Astor FC, Hanft KL, Ciocon JO. Xerostomia: A prevalent condition in the elderly. Ear Nose Throat J. 1999;78:476–9.

50. Sardella A, Lodi G, Demarosi F, Uglietti D, Carrassi A. Causative or precipitating aspects of burning mouth syndrome: A case-control study. Journal of Oral Pathology & Medicine 2006; 35(8), 466–471.

51. Speciali JG, StuginskiBarbosa J. Burning mouth syndrome. Curr Pain Headache Rep. 2008;12:279 284.

52. Epstein JB, Marcoe JH. Topical application of capsaicin for treatment of oral neuropathic pain and trigeminal neuralgia.Oral Surg Oral Med Oral Pathol 1994; 77: 135–40.

53. Gremeau-Richard C, Woda A, Navez ML, et al. Topical clonazepam in stomatodynia: a randomized placebo-controlled study. Pain 2004; 108: 51–7.

54. Petruzzi M, Lauritano D, De Benedittis M, Baldoni M, Serpico R. Systemic capsaicin for burning mouth syndrome: short-term results of a pilot study. J Oral Pathol Med 2004; 33: 111–4.

55. López-Jornet P, Camacho-Alonso F, Leon-Espinosa S. Efficacy of alpha lipoic acid in burning mouth syndrome: a randomized, placebo- treatment study. J Oral Rehabil. 2009;36:52-7.

56. Femiano F. Burning mouth syndrome (BMS): An open trial of comparative efficacy of alphalipoic acid (thioctic acid) with other therapies. Minerva Stomatol. 2002;51:405–9.

57. Cho GS, Han MW, Lee B, et al. Zinc deficiency may be a cause of burning mouth syndrome as zinc replacement therapy has therapeutic effects. J Oral Pathol Med 2010; 39: 722–7.

58. Forabosco A, Criscuolo M, Coukos G, et al. Efficacy of hormone replacement therapy in postmenopausal women with oral discomfort. Oral Surg Oral Med Oral Pathol 1992; 73: 570–4.

59. Sun A, Lin HP, Wang YP, Chen HM, Cheng SJ, Chiang CP. Significant reduction of serum homocysteine level and oral symptoms after different vitamin-supplement treatments in patients with burning mouth syndrome. J Oral Pathol Med 2013. doi:10.1111/jop.12043. in press.

60. Sardella A, Uglietti D, Demarosi F, et al. Benzydamine hydrochloride oral rinses in management of burning mouth syndrome. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1999; 88: 683–6.

61. L_opez, Jornet P, Camacho-Alonso F, Molino-Pagan D. Prospective, randomized, double-blind, clinical evaluation of Aloe vera Barbadensis, applied in combination with a tongue protector to treat burning mouth syndrome. J Oral Pathol Med 2013; 42: 295–301.

62. Grushka M, Epstein J, Mott A. An open-label, dose escalation pilot study of the effect of clonazepam in burning mouth syndrome. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 1998; 86: 557–61.

63. Heckmann SM, Kirchner E, Grushka M, Wichmann MG, Hummel T. A double-blind study on clonazepam in patients with burning mouth syndrome. Laryngoscope 2012; 122: 813–6.

64. Ko JY, Kim MJ, Lee SG, Kho HS. Outcome predictors affecting the efficacy of clonazepam therapy for the management of burning mouth syndrome (BMS). Arch GerontolGeriatr 2012; 55: 755–61.

65. Amos K, Yeoh SC, Farah CS. Combined topical and systemic clonazepam therapy for the management of burning mouth syndrome: a retrospective pilot study. J Orofac Pain 2011; 25: 125–30.

66. Femiano F, Gombos F, Scully C. Burning mouth syndrome: open trial of psychotherapy alone, medication with alphalipoic acid (thioctic acid), and combination therapy. Med Oral 2004; 9: 8–13.

67. Marino R, Torretta S, Capaccio P, Pignataro L, Spadari F. Different therapeutic strategies for burning mouth syndrome: preliminary data. J Oral Pathol Med 2010; 39: 611–6.

68. Maina G, Vitalucci A, Gandolfo S, Bogetto F. Comparative efficacy of SSRIs and amisulpride in burning mouth syndrome: a single-blind study. J Clin Psychiatry 2002; 63: 38– 43.

69. Rodriguez-Cerdeira C, Sanchez-Blanco E. Treatment of burning mouth syndrome with amisulpride. J Clin Med Res 2012; 4: 167–71.

70. Yamazaki Y, Hata H, Kitamori S, et al. An open-label, non comparative, dose escalation pilot study of the effect of paroxetine in treatment of burning mouth syndrome. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2009; 107: e6–11.

71. Bergdahl J, Anneroth G, Perris H. Personality characteristics of patients with resistant burning mouth syndrome. ActaOdontolScand 1995; 53: 7–11