Burning mouth syndrome (BMS) refers to chronic orofacial pain without any visible mucosal changes or lesions and laboratory findings. It is also known by various terminologies such as orofacial pain, stomatodynia, glossodynia, neuropathic pain, glossopyrosis and scalded mouth syndrome. It is characterized by an intense burning or stinging sensation, preferably on the tongue or in other areas of the oral mucosa. The etiology has remained unclear and numerous local, systemic and psychological factors have been implicated in the etiology and current knowledge throws light on the underlying neurological disorder. The International Association for the Study of Pain and International Headache Society defines it as a “distinctive nosological entity, including ‘all forms of burning sensation in the mouth with stinging sensation or pain, in association with an oral mucosa that appears clinically normal in the absence of local or systemic diseases or alterations.’”

BMS is seen more commonly in postmenopausal females. There is no single accepted treatment for BMS and hence there are a variety of therapeutic approaches available. This present article focuses on updated knowledge on etiology, classification of BMS and also adds a note on latest treatment modalities, home remedies and techniques to cope with BMS successfully.

**CLASSIFICATION**

BMS is classified as follows:
- Based on etiology as
  - Primary, where etiology is unknown
  - Secondary, where the etiology is known
- Based on symptoms as
  - Type 1 BMS: Patients have no symptoms upon waking but symptoms progress throughout the day reaching its peak intensity by evening. Night-time symptoms are variable. It is linked to systemic disorders like nutritional deficiency and diabetes.
  - Type 2 BMS: Patients have continuous symptoms throughout the day and are symptomatic at night resulting in sleepless nights. This type is associated with chronic anxiety due to altered sleep pattern and is related to use of antidepressant drugs, which cause xerostomia.
Type 3 BMS: Patients have intermittent symptoms throughout the day with symptom-free periods. Usually seen due to anxiety or allergic reactions especially to food allergens.  

**ETIOLOGIES**

Different factors have been proposed for secondary BMS as follows:
- Local factors
- Systemic factors
- Nutritional factors
- Allergic or immunological factors
- Psychological factors
- Iatrogenic factors
- Infections
- Hormonal imbalances
- Neurological disturbances

**Local Factors**
- Oral conditions: Lichen planus, geographic tongue
- Oral habits: Tongue thrusting, bruxism
- Excessive mouth irritation: Overbrushing, overuse of mouth washes, overingestion of acidic drinks

**Systemic Factors**
- Xerostomia caused by various health problems like Sjogren's syndrome and radiation therapy.
- Gastroesophageal reflux disease (GRED)

**Nutritional Factors**
Deficiencies of B vitamins 1, 2, 6 and 12, as well as zinc, folate and iron, have been suggested as causes of secondary BMS, occurring from direct neurologic damage or in relation to anemia.

**Allergic or Immunological Factors**
Elevated erythrocyte sedimentation rate (ESR) and salivary IgA levels is seen in BMS patients suggestive of immunologic or allergic phenomenon. Allergies are seen in type 3 BMS as intermittent symptoms, associated with signs of mucosal irritation. Suggested irritants include dental materials such as mercury (present in amalgam), methyl methacrylate, cobalt chloride, zinc and benzoyl peroxide. Components of lotions such as petrolatum cadmium sulfate, octyl gallate, benzoic acid and propylene glycol have been implicated. Food allergens include peanuts, chestnuts, cinnamon, nicotinic acid and sorbic acid.

**Psychological Factors**
Patients with BMS show increase in salivary cortisol level indicating higher levels of stress. However, anxiety and depression are considered as exacerbating factors rather than the cause of BMS as the symptoms disappear following their remission.

**Iatrogenic Factors**
Drug-associated BMS have been observed with use of angiotensin-converting enzyme (ACE) inhibitors and angiotensin receptor blockers (ARBs). The product of inflammatory reaction generates increased bradykinin. The mechanism is clearly not understood but kallikrein, a molecule active in the kinin pathway, is increased in the saliva of BMS patients, resulting in increased inflammation. Other drugs like antiretrovirals nevirapine and efavirenz may also result in BMS. However, the mechanism is not clearly understood.

**Infections**
Few microbes like Candida, Enterobacter, Fusospirochetes, Helicobacter pylori and Klebsiella are prevalent in patients with BMS without visible mucosal lesions.

**Endocrine Disorders**
Menopause, whether surgical or physiological, is associated with higher prevalence of BMS. The mechanism is unclear but hormonal alterations may possibly affect the oral mucosa. Estrogen has documented effects on oral mucosa, and deprivation may lead to atrophic changes thereby altering stimulation of the nerve endings within the epithelium. Alternatively, atrophic epithelia may be more prone to inflammation.

Thyroid hormones are involved in maturation and specialization of taste buds and recent studies have shown that thyroid hypofunction may be responsible for hypogeusia, for bitter taste and for the release of inhibitions for sensitive trigeminal sensation.

**Neurological Disorders**
Sensory testing has revealed taste deficits and heat/pain intolerance among BMS patients due to an abnormal interplay between the sensory function of chorda tympani and lingual nerve either in the peripheral or central nervous systems resulting in BMS.
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PATHOPHYSIOLOGY

BMS was originally described as a psychogenic illness, however, a neuropathic mechanism is currently favored. This is based on objectively measured abnormalities of physiologic responses of the trigeminal nerve in BMS patients. Taste to the anterior two-thirds of the tongue is by the chorda tympani branch of facial nerve and somatosensory is supplied by lingual nerve branch of trigeminal nerve. Chorda tympani hypofunction results in lingual nerve hyperfunction by disrupting the centrally-mediated equilibrium between the two. Individuals with high density of fungiform papillae present on the anterior aspect of the tongue are known as supertasters and are more at risk for developing BMS. Supertasters are mainly females who are able to perceive the bitter taste of a substance called PROP (6-n-propylthiouracil) and also experience a more intense burning sensation in the oral cavity, especially when stimulated with chili peppers.

Unilateral anesthesia of the chorda tympani nerve intensifies the perception of burning pain on the contralateral anterior portion of the tongue, suggesting the presence of central inhibitory interactions between taste and oral pain. Damage to the chorda tympani or any alteration in the gustative papillae releases this inhibition, and may lead to an intensification of normal trigeminal sensations leading to spontaneous pain, altered sensations of touch, subjective sensations, of oral dryness and taste alterations (dysgeusia and phantom tastes). Xerostomia seen in BMS is more due to neuropathy than glandular dysfunction. It is noted that salivary content shows differences but there is no change in salivary quantity or flow.

CLINICAL FEATURES

- Occurs most commonly, but not exclusively in females though occurs in men as well.
- Seen in perimenopausal or postmenopausal women
- Unexplained, usually persistent burning sensation or pain of the oral soft tissues.
- The diagnostic criteria for BMS are that pain episodes must occur continuously for at least 4-6 months. They may last for 12 years or more with an average duration of 3.4 years.
- Commonly affects the tongue presenting as glossodynia (painful tongue) and glossopyrosis (burning tongue).

- Symptoms may vary from mild-to-severe but moderate pain is seen frequently.
- Symptoms may appear early in the morning or develop later in the day.
- Altered taste sensation such as bitter or metallic taste
- Oral mucosa appears apparently normal without any visible changes.
- Xerostomia
- Geographic and fissured tongue
- Painful teeth, jaw and temporomandibular joint
- Loss of a comfortable jaw position and uncontrollable jaw tightness
- Headache, neck and shoulder pain
- Increased parafunctional activity
- Difficulty in speaking, nausea, gagging and dysphagia
- Usually bilateral but can be unilateral as well
- Multiple mood and emotional disturbances

INVESTIGATIONS

- Blood tests: Complete blood cell count, glucose level, thyroid function, nutritional factors and immune function
- Oral cultures: For bacterial, viral and fungal infections
- Imaging: Magnetic resonance imaging (MRI), computed tomography (CT) scan or other imaging test to check for other health problems.
- Patch tests: To check allergy to certain foods, additives or even denture materials.
- Sialometric analysis to measure and check salivary flow.
- Psychological questionnaires: To check symptoms of depression, anxiety, etc.
- Gastric reflux tests: To determine GERD.
- Biopsy of tongue or oral mucosa.

TREATMENT AND MANAGEMENT

The goal of treating BMS is to first identify the underlying etiology, then to try to reduce or eliminate the etiology thoroughly. Attempting combinations of therapies may be appropriate as there is no definitive cure. The treatment can thus comprise of medical management, home remedies and self help measures.
Medical Management

Primary BMS
- Behavioral interventions: Cognitive behavioral therapy by a clinical psychologist.
- Topical therapy:
  - Clonazepam, a benzodiazepine, when applied as 0.5-1 mg 2-3 times daily, acts by locally disrupting the neuropathologic mechanism that underlies stomatodynia. But it decreases the density and/or ligand affinity of peripheral benzodiazepine receptors. This, in turn, could cause spontaneous pain from the tissues concerned.\textsuperscript{19,20} Low doses of clonazepam dissolvable wafers available commercially are better than tablets.\textsuperscript{21}
  - Chlordiazepoxide, a benzodiazepine, works by slowing down the movement of chemicals in the brain. This results in a reduction in nervous tension (anxiety) and muscle spasm, and also causes sedation. These effects are unlikely as maximum effect of benzodiazepine is not observed at lower dosage.\textsuperscript{19}
  - Capsaicin induces desensitization to thermal, chemical and mechanical stimuli by inducing selective and reversible desensitization of the afferent sensory C fiber endings. It is used as mouth rinse one teaspoon of a 1:2 dilution or higher of hot pepper and water. The strength of capsaicin can be increased if it can be tolerated by the patient to a maximum of 1:1 dilution. But the restrictions are limited effect over time and magnitude of improvement. Moreover, the use of capsaicin rinse itself produces burning sensation thus limiting the use among patients.\textsuperscript{22,23}
  - Oral lidocaine has also been used topically for relieving the burning sensation.
- Systemic therapy:
  - Clonazepam, a benzodiazepines, exert its effect by acting as a sedative hypnotic 0.25-2 mg dosage/day, 0.25 mg at bedtime, increase dosage by 0.25 every 4-7 days until oral burning is relieved or side effects occur. As the dosage is increased, medication is taken in three divided doses.\textsuperscript{19}
  - Amitriptyline, a tricyclic antidepressant, is given in doses of 10-150 mg/day, to start with 10 mg at bedtime and increase the dose by 10 mg until oral burning is relieved or side effects occur. It is noted that in low doses antidepressants may act as analgesics thereby decreasing chronic pain.\textsuperscript{24}
  - Chlordiazepoxide, a benzodiazepine, is advised 10-30 mg/day, to start with 5 mg at bedtime and increase the dose to 5 mg every 4-7 days until oral burning is relieved. Medication is taken in divided doses as side effects increase as the dosage is increased.\textsuperscript{20}
  - Gabapentin, an anticonvulsant drug, is advised 300-1,600 mg/day; 100 mg at bedtime. The dosage is increased by 100 mg every 4-7 days until oral burning is relieved or side effects occur. As the dosage increases, the medication should be taken in three divided doses.\textsuperscript{25}
  - Alpha lipoic acid is a mitochondrial coenzyme, trometamol salt of thioctic acid. It has antioxidant effect that eliminates the toxic free radicals produced in stress. It has neuro-protective property; hence, used to manage these patients.\textsuperscript{26} Usually administered in doses of 400 mg twice-daily for a month.
  - Acupuncture appears to be the current valid therapeutic choice as it influences oral microcirculation, resulting in a significant variation of the vascular pattern associated with significant reduction of the burning sensation as long as 18 months.\textsuperscript{27}
  - Low level laser therapy may be an alternative treatment for the relief of oral burning in patients with BMS.\textsuperscript{28}

Secondary BMS
Secondary BMS is treated depending on the perceived etiological factor
- Oral thrush: Topical and oral antifungal are used
- Nutritional deficiency: Oral supplements
- Xerostomia: High fluid intake, sialogogues
- Menopause: Hormone replacement therapy
- Cranial nerve injury: Central pain control with benzodiazepines, tricyclic antidepressants, gabapentin, topical capsaicin
- Drug allergy: Change the medication
- Specific oral rinses and mouth washes
- Oral lidocaine and topical steroids can be used

BMS can be managed with medical approaches and variety of drugs. In addition, self help measures and simple home remedies may also be of great help to the patients.
Many patients with BMS show reduction or disappearance of symptoms during meals or when chewing gum or confectionery is used. So the following measures may be taken:

- Sip water frequently
- Chew sugarless gum

Symptoms of BMS can be reduced and also prevented from becoming worse by:

- Avoidance of tobacco products
- Avoidance of products with cinnamon or mint
- Avoidance of spicy and hot foods
- Avoidance of acidic foods and liquids
- Using different brands of toothpastes
- Take steps to reduce excessive stress

Some of these adjunct techniques may help patients in coping up with BMS.

- Practice of relaxation exercise such as yoga
- Joining a pain support group
- Engaging in pleasurable activities such as exercise and hobbies.
- Making an effort to stay socially active by connecting with understanding family members and friends.

**CONCLUSION**

BMS is a difficult and challenging problem for the dental practitioner. It is a clinical diagnosis made via the exclusion of all other causes. No universally accepted diagnostic criteria, laboratory tests, imaging studies or other modalities definitively diagnose or exclude BMS. The key to successful management is a good diagnostic work-up and coordination between the dental practitioners and appropriate physicians and psychologists.

**REFERENCES**


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