Burning Mouth Syndrome: Etiopathogenic Mechanisms, Symptomatology, Diagnosis and Therapeutic Approaches

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Summary: Burning Mouth Syndrome (BMS) is characterised by a continuous, painful burning sensation in a clinically normal appearing oral mucosa. The etiology of BMS remains unknown, although a number of local, systemic and psychological factors have been proposed as being of etiopathogenic importance. Numerous studies indicate that the pathological picture includes both somatic and psychological components. In the dental clinic, the patients' descriptions of the nature of pain and the location of the burning pain appear to be unambiguous and remarkably consistent. Several recent studies indicate that BMS is a neuropathic pain condition, but it is still uncertain whether it is a peripheral and/or a central neurogenic dysfunction. In the psychology clinic, too, BMS patients exhibit unambiguous patterns regarding their reactions to the perception of pain. The reaction is reflected in difficulties in distinguishing between the somatic pain and potential psychological phenomena originating from other life events. These difficulties make it pertinent to identify psychological aspects by a parallel psychological assessment in addition to the somatic one. BMS is an example of a chronic orofacial pain condition that creates major diagnostic and therapeutic problems in the dental clinic.

Conclusions: Today we know that multidisciplinary cooperation is required in this field. An interdisciplinary and transscientific pain clinic would be a relevant forum for assessment and treatment of these patients. From a scientific point of view this would enable us to achieve a greater understanding of the basic etiological mechanisms behind BMS and ultimately to achieve an evidence-based treatment approach.

Key words: burning mouth, neuropathy, xerostomia, alexithymia, psychiatric disturbances

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INTRODUCTION

In the dental clinic, patients with continuous, painful burning sensations in the oral mucosa constitute a familiar problem and present a special challenge regarding diagnosis and treatment. When the burning symptoms persist for over six months and objective clinical findings of local and systemic disorders have not been demonstrated, this condition is known as Burning Mouth Syndrome (BMS) (Grushka, 1987a; Lamey and Lewis, 1989; Merksey et al, 1994; Zakrzewska, 2001; Grushka et al, 2001). The fact that this is referred to as a syndrome indicates the involvement of several simultaneous symptoms of varying intensity, of which the most important are a feeling of oral dryness and taste disturbances (Gorsky et al, 1987; Grushka and Sessle, 1991; Zakrzewska, 1995). BMS can occur both in individuals with natural teeth and in denture wearers. The chronic condition involving a sensation of oral pain and discomfort has considerable negative impact on the patient's general well-being and often reduces the quality of life (Bergdahl et al, 1995a; Jerlang, 1997).

Few epidemiological studies exist elucidating the prevalence of BMS. Several of those studies suffer from

a major weakness in that they are based on selected cohorts of patients. Furthermore, only a few distinguish between the burning mouth symptom and the actual chronic BMS. It should be noted that the literature in this field often lacks clarity regarding the basis for patient selection. As an example, some studies omit to state inclusion criteria, including the applied clinical, somatic examinations to rule out local and/or systemic causes of the patients' burning mouth symptoms. In addition, patient characteristics may lack information on the duration of symptoms and the intake of medications.

The etiology and pathogenesis are still unknown, and there is no causal treatment. The psychological element is an important aspect of the pathological picture. However, it is uncertain whether BMS may be assumed to represent a psychosomatic or psychogenic disorder or whether this condition with its persistent oral pain triggers changes in psychosocial behaviour.

The present article takes stock of current knowledge about BMS and its prevalence, symptomatology, etiopathogenic mechanisms, diagnosis and therapeutic options. The diagnosis of BMS is not particularly well defined, and we need to make the reservation, that some of the study results referred to below are not necessarily based on actual BMS patients.

DEMOGRAPHIC ASPECTS

International estimates of the prevalence vary from 0.7% to 15% (Basker et al, 1978; Tammiala-Salonen et al, 1993a; Lipton et al, 1993; Hakeberg et al, 1997; Zakrzewska et al, 2001). The considerable spread in prevalence between the studies may be due to different definitions of BMS leading to different criteria for the selection of populations (Table 1). According to a recent Swedish epidemiological study, BMS occurs in 3.7% of 1,427 randomly chosen subjects (669 male and 758 female) aged between 20 and 69 years with a prevalence of 1.6% in men and 5.5% in women (Bergdahl et al, 1999). The prevalence of BMS increases with age in both men and women (Bergdahl et al, 1999). The syndrome mainly affects postmenopausal women in the age group 50 to 60 years, where the prevalence increases to about 13% (Ferguson et al, 1981; Bergdahl et al, 1999). Usually BMS first occurs 3 to 12 years after the menopause (Grushka et al, 1987a+b) and rarely before the age of 30 (van der Waal, 1990; Bergdahl et al, 1999). The ratio between women and men varies from 3:1 to 16:1 (Basker et al, 1978; Main and Basker, 1983; van der Ploeg, 1987; Grushka, 1987a; Gorsky et al, 1991). The prevalence of the symptoms of burning mouth is reported to be between 2.6 and 18% (Basker et al, 1978; Ferguson et al, 1981; Locker and Grushka, 1987). Menopausal women have a particularly high incidence of symptoms of burning mouth, regardless of whether they went into menopause naturally through a physiological age-related development or it was surgically induced by an oophorectomy (Ferguson et al, 1981; Ben-Aryeh et al, 1996; Tarkkila et al, 2001). No studies have been conducted on the prevalence of BMS in relation to ethnicity.

Table 1 Definition of burning mouth syndrome (BMS)

Burning mouth syndrome (BMS) A chronic, idiopathic burning sensation or pain in clinically normal oral mucosa in which dental or medical causes have been excluded. The term *syndrome* implicates the simultaneous presence of several symptoms: most frequently a feeling of oral dryness and altered taste in addition to a burning sensation in the oral mucosa (Zakrzewska et al, 2001; Grushka et al, 2002).

Terms previously used to describe what is now called BMS include glossodynia, glossopyrosis, stomatodynia, stomatopyrosis, sore tongue, burning mouth and oral dysaesthesia (Zakrzewska et al, 2001).

Women with BMS have significantly more children (73% have two or more children) than healthy controls (44% have two or more children) (Grushka, 1987a). About two thirds of the BMS patients are housewives (Gorsky et al, 1987), and caring seems to be a predominant occupation (Jerlang, 1993). It has been shown that a woman with BMS often feels closest to one child, although the family has other children (Jerlang, 1993). Most female BMS patients seem to have experienced limited opportunities for self-realisation (Jerlang, 1993). At present, it is not possible to draw firm conclusions with respect to any relationships between BMS and education, social class, marital status and genotype.

SYMPTOMATOLOGY

The cardinal symptom of BMS is a smarting and burning sensation in the oral mucosa. The pain is mainly located in the anterior two thirds of the tongue (71 to 78%) followed by the dorsum and the right and left lateral tongue, the anterior part of the hard palate and the lips (Fig. 1) (Grushka, 1987a; Gorsky et al, 1987;

van der Ploeg, 1987; Svensson et al, 1993a). Patients give very consistent reports on the location of the burning pain. Other sites in the oral mucosa and the throat may be involved (van der Waal, 1990; Tammiala-Salonen et al, 1993a). Usually the burning pain occurs in more than one site in the oral mucosa, and it is often bilateral (Grushka, 1987a). Although an increased incidence of geographic tongue has been described in BMS (Gorsky et al, 1987; Maresky et al, 1993), it should be stressed that BMS is characterised by the presence of a clinically normal oral mucosa (Grushka, 1987a).

Over half the patients with BMS experience spontaneous onset of the symptoms, without any evident triggering factor (Grushka et al, 1987b; Grushka and Sessle, 1991). However, about one third of the patients relate the onset of symptoms to dental treatment, including antibiotic therapy for dental problems (Grushka et al, 1987b; Hammaren and Hugoson, 1989). Other patients claim that the onset of symptoms relates to traumatic life events such as a death in the family (Grushka et al, 1987b; van der Ploeg, 1987; Grushka and Sessle, 1991). Characteristically the symptoms occur continuously over a period of months or years without any clear periods of cessation or remission (Grushka et al, 1987b; Jerlang, 1993). A semi-spontaneous relief of symptoms occurred in half to two-thirds of the patients after six or seven years, characterised by a change in pain pattern from constant pain to episodic burning symptoms (Grushka et al, 1987b; Ship et al, 1995). Patients who have become completely or partially symptom-free do not differ from those with continuous burning symptoms as regards age, sex, disease duration or location of symptoms (Grushka et al, 1987b).

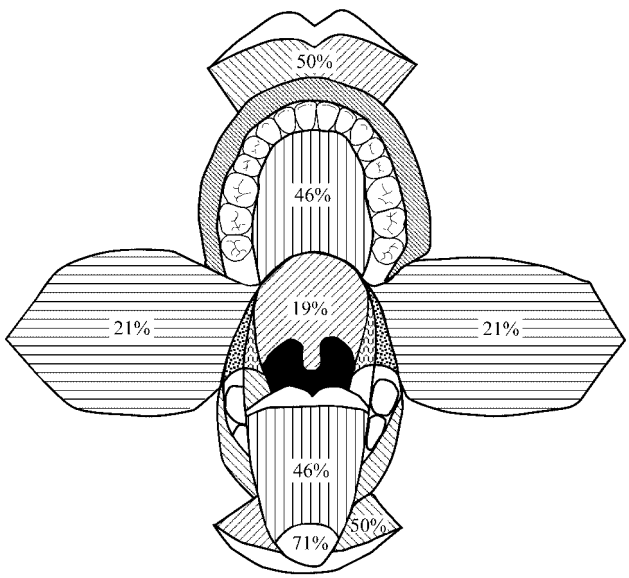

Fig. 1 Incidence of burning sensation at various oral mucosal sites in patients with BMS (Grushka, 1987a; van der Ploeg, 1987; Svensson et al, 1993a).

Lamey and Lamb (1988) have suggested a classification of BMS with three sub-types according to variations in pain intensity over 24 hours. Type 1 is defined as the daily occurrence of burning symptoms that increase during the course of the day, but are not present at waking up. Type 2 is defined as the constant, day and night presence of burning symptoms. Finally, type 3 is defined as symptoms without daily occurrence and varying as regards location. In some instances, however, the last-mentioned sub-type included patients whose symptoms could be related to allergies (Lamey et al, 1994).

The pattern of daily symptoms seems fairly stable for the individual patient (van der Ploeg, 1987). For example, about one third of the patients experience symptoms both day and night (van der Ploeg, 1987; Grushka, 1987a; Bergdahl et al, 1999). Most patients have negligible symptoms when they wake up, after which the symptoms gradually increase during the day to culminate in the evening (Grushka, 1987a). About one third of the patients have difficulties falling asleep and wake up during the night (van der Ploeg, 1987; Grushka et al, 2002). Sleep disturbances and the presence of constant pain may contribute to explaining the increased incidence in changes of mood, irritability and depression reported among BMS patients (Grushka et al, 1987c; Grinspin et al, 1995). Yet other patients experience symptom-free days and are classified as BMS type 3. The intensity of the burning sensation in the oral cavity of BMS has been described as moderate to severe, and in some cases it is comparable to the intensity of pain at toothache as regards its quantity, but not its quality (Grushka et al, 1987c). Meanwhile, comparing pain in BMS with another chronic pain condition and not the acute pain of toothache might create a more representative picture. The use of a visual analogue scale from 0 to 10 for subjective quantification of pain has demonstrated an average pain intensity of 8 among BMS patients (Lamey and Lamb, 1988). However, in a more recent study it was considerably lower, i.e. at 4.6 (Bergdahl et al, 1999). In the majority of patients, the burning sensation worsened in the presence of tension, fatigue, speaking and food ingestion (Grushka, 1987a). In about half the patients, however, the intake of food or cold drinks, absorption in work or similar distractions alleviate the symptoms (Grushka,

1987a). It is still not clear how tobacco smoking, alcohol and drugs affect the symptomatology of BMS. A large proportion of BMS patients takes one to three drugs every day (Hammaren and Hugoson, 1989), mainly antidepressant and antihypertensive agents. About two thirds of the patients use sedatives and/or hypnotics daily (van der Ploeg, 1987; Jerlang, 1997). The extent of self-medication, as opposed to drugs prescribed by a physician, turned out to be significantly higher in BMS patients, especially in male patients, than in patients with symptoms of burning mouth of varying, but known etiology (Maresky et al, 1993).

Other Oral Symptoms

Table 2 shows a number of frequently reported symptoms and symptom-producing conditions of BMS. Patients with BMS have a significantly higher incidence of dry mouth, thirst and taste disturbances, but they do not differ from healthy controls regarding changes in oral mucosa or dental problems (Feinmann et al, 1984; Grushka, 1987a; Grushka and Sessle, 1991; Hampf et al, 1987). Thus over two thirds of the patients complain about dry mouth (Gorsky et al, 1987; Grushka, 1987a; Bergdahl et al, 1999). Taste disturbances occur in two thirds of the patients and may appear as a persistent taste (predominantly bitter and/or metallic) or a change in taste intensity (Grushka et al, 1986). A combination of these taste disturbances may occur.

Table 2 Frequently reported symptoms and conditions in patients with BMS

Orofacial symptoms
Prickling, smarting or burning sensation in the mouth
Feeling of oral dryness
Persistent or altered taste perception
Reduced sense of smell
Burning sensation in the nose
Difficulty in swallowing
Myalgia
General symptoms and conditions
Headache
Migraine
Dizziness, vertigo
Joint and muscle pains, particularly in the neck and back
Dysfunctional uterine bleeding
Nausea
Gastro-oesophageal reflux
Flatulence
Altered eating patterns
Psychological consequences
Anxiety, depression
Sleep disturbances
Despair
Hopelessness
Sadness

Other Somatic Symptoms

BMS patients have more non-specific health complaints and severe menopausal symptoms than healthy controls (Grushka, 1987a). Headache, migraine, dizziness, neck pain and back pain, skin disorders, irritable bowel syndrome and menstrual disturbances and sleep disorders are the most important conditions producing symptoms (Table 2) (Feinmann et al, 1984; van der Ploeg, 1987; Hammaren and Hugoson, 1989; Jerlang, 1997).

ETIOPATHOGENIC MECHANISMS

The cause of BMS and the pathogenic mechanisms behind it are still unknown (van der Waal, 1990; Zakrzewska, 1995; Zakrzewska et al, 2001). The etiology is presumed to be multifactorial, involving an interaction between biological (neurophysiological) and psychological factors (Zakrzewska, 1995). Table 3 shows a number of etiopathogenic mechanisms suggested for BMS. Several of the factors stated in the table should be considered as conditions important to differential diagnosis of a burning pain in the oral mucosa rather than as proper etiopathogenic factors.

A considerable number of local, oral factors have been found to relate to BMS, including: xerostomia, which implies the subjective sensation of dry mouth (Basker et al, 1978; Gorsky et al, 1986; Grushka, 1987a); hyposalivation, which denotes objectively reduced saliva secretion measured by sialometry (Lamey and Lewis, 1988; Gorsky et al, 1991; Grushka and Sessle, 1991); taste disturbances (Grushka et al, 1986; Formaker et al, 2000); oral candidiasis (Zegarelli, 1984; Samaranayake et al, 1989); temporomandibular functional disorders (Thorstensson and Hugoson, 1996; Paterson et al, 1995); allergic reactions (Kaaber et al, 1979; Lamey and Lamb, 1988; Haustein, 1988; Lamey et al, 1994); and denture-related problems (Lamey and Lamb, 1988; Svensson et al, 1995). In addition, several systemic factors such as oestrogen deficiency, vitamin and mineral deficiencies and psychological phenomena are purportedly involved in BMS (van der Waal, 1990; Mott and Grushka, 1993; Zakrzewska, 1995). The last-mentioned includes states of anxiety, depression and cancerophobia and several personality traits (Browning

Table 3 Dental and medical conditions of differential diagnostic importance in relation to burning discomfort and pain in the oral cavity. Several of these conditions have also been suggested as possible aetiological and pathogenic factors in BMS

Local Factors
Dental treatment including dentures (Basker et al, 1978; Lamey and Lamb, 1988; Svensson et al, 1995).
Oral mucosal changes/diseases: oral lichen planus, geographic tongue (Zegarelli, 1984).
Allergic reactions (Kaaber et al, 1979; Haustein,1988; Lamey, et al, 1994; Virgilli et al, 1996).
Oral candidiasis (Samaranayake et al, 1989; Chen and Samaranayake, 2000).
Oral dys- and parafunctions, tongue thrusting (Jontell et al, 1985; Svensson et al, 1995; Paterson et al, 1995).
Temporomandibular disorders (Paterson et al, 1995; Thorstensson and Hugoson, 1996).
Xerostomia and hyposalivation, altered saliva composition (Lamey and Lamb, 1988; Gorsky et al, 1991; Lamey et al, 2001; Chimenos-Kustner and Marques-Soares, 2002)
Neurogenic traumas including neuroma (Ship et al, 1995).
Systemic Factors
Nutritional disturbances, vitamin deficiencies: anaemia, vitamin B1, B2 and B6 deficiencies, zinc deficiency (Lamey et al, 1986; Hugoson and Thorstensson, 1991; Vucicevic-Boras et al, 2001)
Iatrogenic: medications such as angiotensin-converting enzyme inhibitors (Savino and Haushalter 1992), levothyroxine (Bergdahl et al, 1995a), neurogenic traumas.
Hormonal disturbances: menopause, oestrogen deficiency (Basker et al, 1978; Grushka, 1987a), diabetes (Brody et al, 1971; Basker et al, 1978).
Immunological disturbances: autoimmune diseases, HIV and AIDS (Grushka and Sessle, 1991).
Psychogenic and Psychiatric Factors
Anxiety, depression, somatisation and cancerophobia (Browning et al, 1987; Lamb et al, 1988; Grushka et al, 1987c; Bergdahl et al, 1995a; Jerlang, 1997).

et al, 1987; Lamb et al, 1988; Grushka et al, 1987c; Bergdahl et al, 1995; Jerlang 1997).

Saliva Secretion and Saliva Composition

Xerostomia is a frequent complaint in patients with BMS (30 to 70%), and it has been suggested that reduced salivation may play a part in the development of this syndrome (Lamey and Lewis, 1988; Gorsky et al, 1991). However, the secretion of both whole saliva and parotid saliva proved normal compared with healthy controls (Glick et al, 1976; Syrjänen et al, 1984; Tammiala-Salonen et al, 1993b; Lundy et al, 1997; Lamey et al, 2001). These results agree with observations from previous studies, which showed that there is no reduction of saliva secretion in postmenopausal women or in elderly, non-medicated healthy subjects (Baum, 1989; Wu et al, 1993; Pedersen et al, 1999). Xerostomia and/or hyposalivation may have several causes, the intake of medications being the most frequent one (Sreebny and Schwartz, 1997). Not surprisingly, a recent study has shown that stimulated parotid saliva secretion is reduced in BMS patients taking antidepressants, but normal in unmedicated BMS patients (Lamey et al, 2001). The relationship between anxiety and depression (which are frequently reported mental disorders in BMS patients), and dry mouth/reduced saliva secretions, is still unknown. Patients with major symptoms of anxiety and depression are likely to receive treatment with anxiolytics and/or antidepressants, which are both known to cause dry mouth and hyposalivation.

The symptom may often be ascribed to changes in saliva composition and viscosity (Chimenos-Kustner and Marque-Soares, 2002) in patients who complain about dry mouth, but who do not suffer from reduced saliva secretion. A limited number of sialochemical studies have been performed in BMS patients, which showed no alterations in the protein composition of whole saliva and parotid saliva, including the contents of glycoproteins and their agglutinating and adhesive properties, compared with healthy age- and sex-matched controls (Lundy et al, 1997; Tammiala-Salonen et al, 1993b). In a study of post-menopausal women with idiopathic glossodynia, the concentrations of total protein, potassium and phosphate in non-stimulated whole saliva were higher than in healthy controls (Glick et al, 1976). The high phosphate content in whole saliva was interpreted as a marker of hormonal imbalance. In patients with oral symptoms analogous to those described in so-called 'oral galvanism', the concentrations of total protein, sodium, chloride and phosphate in whole chewing-stimulated saliva were higher than in age- and sex-matched asymptomatic patients (Syrjänen et al, 1984). Contrary to this, the values of IgA, calcium and magnesium were lower. Alterations in saliva composition could be explained by an irritation-mediated impact (burning pain) on taste perception and thus an impact on secretory rate and saliva composition. However, it is still unclear whether the patient groups in the two last-mentioned studies actually fulfil the criteria for BMS. Apparently no studies have examined saliva flow rate and saliva composition in samples collected from the submandibular/sublingual glands and the labial glands in patients with BMS, in spite of the fact the locations in the oral cavity

most frequently affected by burning pain are constantly exposed to secretion from these glands.

Taste and Pain Perception Disorders

In patients with BMS, the burning pain is typically located in the anterior part of the oral cavity, and it appears in both non-keratinised and keratinised areas of the oral mucosa. The perception of pain is related to the free nerve endings in the oral mucosa acting as nociceptors. These nociceptive nerve fibres comprise unmyelinated C-fibres and myelinated A-delta fibres are most frequently located in the connective tissue and around the subepithelial capillary plexus and they are activated by inflammatory mediators and by mechanical and thermal stimuli (Ferguson, 1999). It is characteristic that the part of the oral cavity mostly affected in BMS represents a region with a high density of nerve endings and cortical representation in the brain. To this should be added that the oral cavity, and especially its anterior part, is almost constantly exposed to both exogenous and endogenous stimuli including touch, pressure, heat, cold and taste. Taste buds, tongue papillae, salivary glands and their secretions, blood vessels and nociceptors constitute a complicated interaction that renders it difficult to clarify the pathophysiological mechanisms of BMS. However, the results of an increasing number of psychological and neurophysiological studies support the probability of a neurogenic pathophysiology of BMS.

Some claim that BMS is a neuropathic pain condition, where the pain may be ascribed to a dysfunction of both the peripheral and central nervous system (Ship et al, 1995). Neuropathic pain is characterised by a smarting, burning sensation, and it is frequently connected with several chronic pain conditions. Neuropathic pain is the result of damage to neurogenic structures in the peripheral and/or the central nervous system (Lund et al, 2001). After the injury, which may include direct nerve damage or tissue inflammation, the peripheral afferent nerve fibres react with increased excitability and spontaneous tonic activity. This may release permanent neuroplastic alterations in the central neurons that contribute to maintain the nociceptive activity. Because of an increase in non-nociceptive A-beta nerve fibre activity, a neuropathic pain condition is often accompanied by somatosensory disturbances. However, Grushka et al (1987d) found no significant somatosensory disturbances with respect to tactile sensation, two-point discrimination, temperature perception and stereognostic ability in the orofacial region in patients with BMS compared with age- and sex-matched controls. The same study did, however, reveal a significantly lower pain tolerance in BMS patients than in controls at thermal (heat) stimulation of the apical part of the tongue (Grushka et al, 1987d). Like Grushka et al (1987d), Lamey et al (1996) found no somatosensory disturbances in relation to the perception of the size of different stimuli. These results indicate that the function of A-delta fibres, which subserve most of the touch sensation, is intact, and they do not support the presumption of a neuropathic pain condition. Contrary to this, however, some sensophysiological studies indicate somatosensory disorders in BMS patients. They have demonstrated significantly increased sensory thresholds and pain thresholds in BMS patients compared with age- and sex-matched controls following stimulation with argon laser (Svensson et al, 1995). In addition they found qualitative and quantitative disturbances in the ratio between non-nociceptive and nociceptive influences (Svensson et al, 1995). A recent experimental pain study has demonstrated elevated pain thresholds on the tongues of female patients with BMS after application of both thermal and mechanical pain stimuli, compared with age-matched female controls (Ito et al, 2002). In addition, increased vasoconstriction triggered by cold has been demonstrated in the oral mucosa corresponding to areas with burning symptoms, especially in the palate (Heckmann et al, 2001). Furthermore, increased excitability of the blinking reflex (a brainstem reflex under inhibitory dopaminergic control) and signs of allodynia and hypoaesthesia were found in a group of patients with BMS (Jääskeläinen et al, 1997; Forssell et al, 2002), which supports the assumption that BMS constitutes a neuropathic pain condition. Another study has examined the dopaminergic function in the striatum (putamen and caudatus), which is part of the basal ganglia in the midbrain (Jääskeläinen et al, 2001). The basal ganglia are presumed to be involved in our perception and experience of pain. The results of the study indicate that inhibition of the dopaminergic nigrostriatal system is reduced in BMS patients compared with healthy controls. These observations seen in relation to the finding of the abnormal blinking reflex indicate that a low dopaminergic activity in the striatum may be associated with clinical pain disorders such as BMS. The BMS patients participating in the study showed no signs of motor dysfunctions or psychiatric disorders, which supports the hypothesis that the pain sensation in BMS is exclusively a nociceptive projection (Jääskeläinen et al, 2001).

As stated above, the oral burning pain involved in BMS is often accompanied by taste alterations (Grushka et al, 1986). Chemosensory studies have shown that

the perception of both a salt, sweet, sour and bitter taste may be altered in patients with BMS (Grushka et al, 1986; Formaker et al, 2000). The persistent taste is typically perceived as a bitter and/or metallic taste. Bitter and sour tastes are often enhanced, while the intensity of sweet and salt tastes is reduced (Grushka et al, 1986; Formaker et al, 2000). Also, female BMS patients have greater difficulties identifying different taste stimuli than age-matched female controls (Formaker et al, 2000). Thus the effect of chronic pain (the oral burning sensation) does seem to alter taste perception (Formaker et al, 2000). One possible explanation could be that the afferent sensory nerve fibres in the tongue from the trigeminal nerve and the afferent gustatory nerve fibres from the chorda tympani (from the facial nerve) have overlapping receptive fields in the anterior part of the tongue, which is the characteristic seat of the burning pain (Grushka et al, 1986). The chorda tympani nerve fibres contribute 25% of innervation to the fungiform papillae and the trigeminal nerve contributes 75% (Beidler, 1969; Miller, 1976). Taste fibres from the chorda tympani nerve synapse with cells in the taste bud, while sensory fibres from the trigeminal nerve surround each taste bud, and terminate in the part of the fungiform papilla where there is least keratinisation (Bartoshuk, 2000). This may increase the vulnerability to thermal and mechanical stimuli, thereby affecting the development of pain in this part of the oral cavity. The mentioned location of sensory nerve fibres from the trigeminal nerve, which also contain substance P and calcitonin gene-related peptide (neuropeptides with enhancing effect on nociceptive transmission and spinal nociceptive transmission) supports the presumption of an interaction between the taste system and the somatosensory system (Bartoshuk et al, 1996). Purportedly damage to the taste system may trigger central inhibition of afferent pain fibres from the trigeminal nerve, leading to intensified oral burning pain including phantom pain (Bartoshuk et al, 1999). Some BMS patients have been shown to exhibit signs of damage to the chorda tympani, and the pain intensity in those patients is proportional to the number of fungiform papillae on the tongue. These results indicate that the BMS patients with the most intense experience of pain are also so-called 'supertasters' (Bartoshuk et al, 1998). 'Supertasters' are individuals, mostly women, who are able to perceive the very bitter taste of a substance called PROP (6-n-propyl-thiouracil), but who, due to the morphology of the taste system, also experience a more intense burning sensation in the oral cavity, especially when stimulated with chilli pepper, etc. (Bartoshuk, 2000). In this connection it might be interesting to mention that a previous experimental pain study has shown that BMS patients perceive a significantly more intense burning pain in the oral mucosa following exposure to capsaicin (a chemical irritant found in chilli pepper with a selective effect on pain-mediating C-fibres) than matched controls (Svensson et al, 1993b). Unilateral analgesia of the chorda tympani nerve has proved to intensify the perception of burning pain on the contra-lateral anterior part of the tongue (Tie et al, 1999). Furthermore, application of a local analgesic (dyclonine hydrochloride) has been found to reduce the altered/persistent taste in patients with BMS, while the oral burning pain was intensified or remained unchanged in two thirds of the patients (Formaker et al, 1998). Accordingly, several findings indicate that the neurogenic interaction between the taste system and the somatosensory system takes place at central level.

Previous studies and a steadily growing number of current neurophysiological studies indicate that BMS represents a pain condition that includes neuropathological mechanisms involving the peripheral and/or the central nervous system. It is still not clear whether there exists a peripheral receptor dysfunction, a central dysfunction or disturbance in the processing of sensory impulses from the trigeminal facial system. More studies are needed to elucidate the interaction between both central and peripheral nociceptive neurons and the gustatory system.

Temporomandibular Dysfunctions, Parafunctions and Denture-related Problems

Clinical studies of denture-wearing BMS patients indicate that biophysiological mechanisms play a role in the pathogenesis (Lamey and Lamb, 1988; Svensson et al, 1995; Paterson et al, 1995). In most of the denture-wearing BMS patients, morphological changes of the tongue muscles have been observed, taking the form of macroglossia, chronic muscle tension and a burning sensation in the apical and dorsal parts of the tongue, the mucosa of the hard palate and the labial mucosa (Svensson et al, 1995). Inadequately formed dentures regarding inter-alveolar distance and secondary stabilising surfaces are often reported as the cause of burning mouth complaints (Main et al, 1983; Lamey and Lamb, 1988). It has also been suggested that chronic tongue thrusting triggered by psychosocial or psychosomatic factors may produce a traumatic impact on the nociceptors in the apical part of the tongue, the mucosa of the hard palate and the labial mucosa (Svensson et al, 1995). If such a condition persists, it may cause sensitisation of the peripheral and central transmission of

impulses, and previous non-nociceptive impulses could be misinterpreted as a burning pain (Svensson et al, 1995). It has also been suggested that this may occur through the repeated inappropriate pressure of dentures on the underlying mucosa (Basker et al, 1978). Parafunctional activities resulting in pronounced occlusal wear of dentition or dentures were found in 61% of BMS patients (Paterson et al, 1995). However, other studies have failed to demonstrate a correlation between denture provision and the onset of BMS (Nater et al, 1978; Gorsky et al, 1987). In a clinical study comprising 533 randomly selected individuals, 3.4% reported a prickling and burning sensation in the oral cavity, which correlated to mandibular dysfunction (Thorstensson and Hugoson, 1996).

Oral Infections and Alterations in the Oral Mucosa

Oral candidiasis has frequently been quoted as an etiological factor of BMS (Zegarelli, 1984; Gorsky et al, 1987; Samaranayake et al, 1989; Gorsky et al, 1991). The prevalence of Candida species in the oral cavity was found to be higher in BMS patients without clinical signs of a candidal infection than in individuals without any burning mouth symptoms (Samaranayake et al, 1989). A recent study has shown significantly higher *in vitro* growth of *Candida (C.) glabrata*, but not of *C. albicans* and *C. tropicalis* in parotid saliva from 20 BMS patients compared to 13 age-matched controls (Chen and Samaranayake, 2000). The clinical and pathogenic significance of this finding is still unknown. Usually candidal infections are accompanied by visible alterations in the oral mucosa and should be regarded more as a differential diagnosis. Other alterations in the oral mucosa such as geographic tongue have been observed in 15% of BMS patients (Gorsky et al, 1987). However, patients with geographic tongue may have symptoms of burning mouth in sites that usually correspond with the clinically visible alterations, i.e. areas with depapillation of the filiform papillae. *Helicobacter* pylori colonisation in tongue mucosa was more commonly found in patients with BMS than in those with migratory glossitis (Gall-Troselj et al, 2001). The difference could be partly explained by any concomitant systemic disorders and the use of drugs of the patient populations.

Allergic Reactions

Several allergens such as methyl methacrylate monomer, nickel sulphate, cobalt and mercury have been related to the development of BMS (Kaaber et al, 1979; James et al, 1985; Haustein, 1988; Dutree-Meulenberg et al, 1992; Lamey et al, 1994). It is commonly believed that, in denture wearers, pain in the oral mucosa is often due to sensitisation of the mucosa under the dentures to allergenic components in the denture base material. In a dermatological study including epicutaneous patch tests of 53 denture-wearing BMS patients, 23% of the patients exhibited positive cutaneous reactions to known allergenic acrylate components in dentures (Kaaber et al, 1979). Apparently, several of the patients had diffuse or symptomatic denture stomatitis, and when they had new dentures made of alternative materials, they obtained complete or partial symptom relief. Contact allergy to chemical components in denture base materials was also observed in 27% of patients with BMS (Dutree-Meulenberg et al, 1992), while a similar study observed no cutaneous reactions in 23 BMS patients (Wakkers-Garritsen et al, 1975). Allergy-associated oral burning seems to affect patients already suffering from a type 1 or type 2 verified allergy (Antico, 1996). Other studies indicate that haptens in denture acrylate are unlikely to be the cause of BMS in denture wearers, but that the burning symptoms should be ascribed to mechanical irritation contingent on inadequately shaped dentures combined with tongue thrusting, teeth grinding and other oral parafunctions (Main et al, 1983; Jontell et al, 1985; Lamey and Lamb, 1988; Paterson et al, 1995). Finally it should be noted that BMS is not limited to denture-wearing patients.

Food sensitivity has also been mentioned as a possible etiological factor in BMS (Virgilli et al, 1996). Burning mouth symptoms have been reported following exposure to preservatives, taste additives and other additives in food and toiletries such as sorbic acid (preservative), cinnamon aldehyde (taste additive in food and toothpaste) and nicotinic acid (Lamey and Lamb, 1988; Haustein, 1988; Lamey et al, 1994). However, food allergies usually exhibit fluctuating symptoms, and allergy evaluation would be indicated.

Systemic Factors

Deficiency disorders, hormonal and immunological disorders and pharmacological side-effects are often mentioned as etiological factors involved in BMS. Iron deficiency anaemia and vitamin B12 deficiency are the most frequently stated etiological and pathogenic factors in BMS, but a causal relationship has not been found, nor have any controlled clinical studies demonstrated the effect of treating BMS symptomatology with iron and vitamin B12 (Basker et al, 1979; Lamey et al, 1988; Ali et al, 1986; Hugoson and Thorstensson, 1991). In a clinical uncontrolled study, remission is re-

ported for 88% of BMS patients following treatment with vitamins B1, B2 and B6 (Lamey et al, 1986), but other studies have failed to confirm this effect (Hugoson and Thorstensson, 1991). A recent study showed normal serum levels of iron, folic acid, calcium and magnesium but significantly lower levels of B12 in patients with BMS compared with age-matched controls (Vucicevic-Boras et al, 2001). Several studies have demonstrated normal haematology and oral mucosa without any visible alterations corresponding to vitamin deficiencies (Grushka et al, 2002). Contrary to this, elevated sedimentation rates, elevated serological rheumatoid factors and antinuclear factors have been demonstrated in approximately 60% of a group of BMS patients, which indicates increased immunological activity and possibly the presence of auto-immune diseases (Grushka, 1987a). However, a correlation between immunological disorders, including connective tissue disorders and BMS has not been demonstrated.

The hypothesis of sex hormone disorders as an etiological and pathogenic factor in BMS is based on the predilection of the syndrome for menopausal and postmenopausal women. However, hormone replacement therapy with oestrogen alone or in combination with progestogens has had no effect on the burning symptoms (Pisanty et al, 1975; Basker et al, 1978; Ferguson et al, 1981; Forabosco, 1992). Menopausal complaints and BMS symptoms have been shown to correlate in women with oestrogen deficiency (Basker et al, 1978), and BMS patients have more severe menopausal symptoms than the controls (Grushka, 1987a). It should be mentioned in this connection that several experimental studies indicate that the oestrogen level affects the perception of pain. Thus it has been demonstrated that menopausal women receiving hormone replacement therapy (HRT) show less response to thermal pain stimuli than those who do not receive HRT (Fillingim and Edwards, 2001). The impact of sex hormonal factors on the onset and persistence of BMS is still not clear.

Several earlier studies have suggested a possible causal relationship between diabetes mellitus and BMS, but this correlation has not been confirmed (Brody et al, 1971; Basker et al, 1978; Zegarelli, 1984; Mott et al, 1993). Diabetic patients are more susceptible to oral candidiasis, which may present with symptoms such as burning mouth, but this may also be secondary to diabetic autonomic neuropathy (Tourne and Friction, 1992; Carrington et al, 2001).

Psychogenic Factors

Psychogenic factors were first described for BMS in 1946 (Ziskin and Moulton, 1946). Since then, studies have sought to clarify whether these factors and/or psychiatric disorders are part of the etiology and pathogenesis of the syndrome or whether they should be regarded as secondary to chronic pain. However, evidence of a causal relationship between BMS and psychogenic factors has not been proven.

Psychiatric Disorders

Psychiatric disorders are often described in patients with BMS with anxiety and depression as the most important ones, but hypochondria and cancerophobia are also mentioned (Schoenberg, 1971; Zegarelli, 1984; van der Ploeg, 1987; Browning et al, 1987; Loldrup et al, 1989; Lamb et al, 1988; Lamey and Lamb, 1988; Hammaren and Hugoson, 1989; Zilli et al, 1989; Lamey et al, 1994; Rojo et al, 1993; Paterson et al, 1995; Bogetto et al, 1997; Eli et al, 1994). In addition, a few studies report findings of personality disorders (Hampf et al, 1987; Jerlang, 1993).

No proper epidemiological studies have been performed to determine the prevalence of psychiatric disorders in BMS, and estimates vary. Clinical controlled studies applying semi-structured diagnostic interviews have reported comorbid psychiatric disorders to range between 44% and 59.8% in patients with BMS and between 16% and 23.5% in age- and sex-matched controls (Browning et al, 1987; Bogetto et al, 1997). This agrees with the finding of an uncontrolled study in which the prevalence was 51.33% (Rojo et al, 1993). The majority of BMS patients experience a depressive episode or a generalised anxiety reaction following the diagnosis of BMS (Bogetto et al, 1997). Further, some studies show that up to 70% of BMS patients have experienced a psychiatric disorder at some point in their lives (Bogetto et al, 1997) or they have previously been in contact with the mental health services (Zegarelli, 1984).

Psychometric studies have discovered more severe psychiatric symptoms in BMS patients than in normal populations and other chronic pain patients, but less severe symptoms than in other psychiatric populations (van der Ploeg, 1987; Rojo et al, 1993). However, other studies found no significant prevalence of psychiatric symptoms (Trikkas et al, 1996; Carlson et al, 2000). Carlson et al (2000) emphasise, however, that several individual profiles indicate a potential psychiatric symptomatology, although the group profile is not significant.

The above variations in the prevalence of psychiatric disorders may reflect the different basis for patient selection and/or use of different methodologies for measuring psychiatric disorders. Psychometric tests

may apply different scoring systems and cut-off values, and variations in results may depend on whether ratings were performed by the patient or by professionals (Carlson et al, 2000).

Psychological Profile

Psychometric studies report that BMS patients predominantly exhibit a neurotic personality profile (Grushka et al, 1986; van der Ploeg, 1987; Loldrup et al, 1989). Also clinical studies have found personality disorders varying from neurotic to personality organisation at borderline level[1] (Hampf et al, 1987; Jerlang, 1993). In addition, reports exist of other psychological traits such as socialising difficulties, including a tendency to isolation, somatisation, dysphoria and anxiety in BMS patients (Bergdahl et al, 1995a; Jerlang, 1993). Different personality profiles in BMS patients may be ascribed to differences between psychometric tests and clinical interviews, since, as mentioned, contrary to psychometric tests clinical interviews allow for evaluation of personality structure and dynamics[2].

Alexithymia is another personality trait associated with BMS[3]. Two studies have shown that significant numbers of BMS patients have either latent or manifest signs of alexithymia (Hammaren et al, 1989; Jerlang, 1997). Other studies have also demonstrated an increased, but not significant prevalence of alexithymia in BMS patients compared with healthy controls (Miyaoka, 1996; Trikkas, 1996). The presence of alexithymic traits is likely to affect the difficulties experienced by BMS patients in distinguishing between mental and physical stimuli (Jerlang, 1997).

Presumably BMS patients also have different typological profiles. Accordingly, type 2 BMS patients have more serious psychological characteristics, including somatic anxiety, sad thoughts and a lack of initiative than type 1 and 3 BMS patients and healthy controls (Lamb et al, 1988; Bergdahl et al, 1995a). However, Bogetto et al (1997) found no correlation between type 1 and 3 BMS and psychiatric comorbidity, life events and BMS symptomatology. Differentiating between the three BMS sub-types can be difficult, which is reflected in the above diverging study results.

Within psychoneuroimmunology as a field of research, the possible associations between stress and the outbreak of a disease have long attracted attention (Lutgendorf, 2003). Difficult life events and/or other forms of psychosocial stress are seen as stressors that may lower immune response and increase somatic weakness. It has been demonstrated that the majority of BMS patients report painful life events. It seems, however, not to be the number of difficult life events, but rather the severity of a life event that triggers the onset of BMS (Bogetto et al, 1997). Initiation of BMS often occurs after a severe life event such as a divorce or the loss of a significant other, but it is presumed to be the BMS patient's way of experiencing and processing the loss, i.e. the personality organisation as well as the presence of alexithymic traits, that is the decisive factor and not the severe life event as such (Jerlang, 1997).

Pain and Psychogenic Factors

Studies of BMS patients and their pain threshold and tolerance have previously been used to clarify whether psychogenic factors are indeed part of the etiology of BMS. In their clinical experimental study, Svensson and Kaaber (1995) concluded that BMS patients do not exaggerate their complaints about pain, and that the affective component in pain perception measured by psychometric tests for self-assessment corresponds to that of the normal population and is lower than in other chronic pain patients with a known somatic cause. In another experimental study, Grushka et al (1987d) found that BMS patients have a lower pain tolerance on the tip of the tongue than healthy controls, while the pain threshold is the same in BMS patients and controls. Contrary to this, Ito et al (2002) found that the pain threshold in the tongue is significantly higher in BMS patients than in healthy controls, and that BMS patients persistently complain of pain after cessation of the experimental pain, which is seen as a sign of peripheral neurogenic dysfunction on the tongue and/or central dysfunction. Another experimental study concluded that the pain perceptions of BMS patients are not exaggerated, since their intensity corresponds to that of toothache, although they differ in sensory qualities (Grushka et al, 1987c). To this, Zilli et al (1989) objected that the pain threshold is a more stable phenomenon than pain tolerance. Thus pain threshold is defined as purely sensory data, while pain tolerance also includes the thoughts and feelings in-

[1] The concepts neurotic organisation and borderline personality organisation are interpreted according to Kernberg's definitions (Kernberg, 1984; Clarkin, 1999).

[2] The target for the clinical interview includes an assessment of personality structure (current state and personality traits), personality dynamics (traits such as needs, attitudes, relations), and differential diagnostic considerations.

[3] This concepts concerns the phenomenon that the patient has difficulties identifying and processing psychic discomfort through the form of mentalisation that usually processes and thereby neutralises mental discomfort.

volved in the perception of pain. Grushka et al (1987c) found that the pain perceptions of BMS patients relate to their psychiatric disturbances as measured by psychometric testing. However, they conclude that the observed psychiatric disturbances should be seen as reactive and that BMS could not be considered to be of psychogenic origin. Similar to Grushka et al (1987c), Carlson et al (2000) found that the sensory pain of BMS patients cannot be associated to psychological dysfunction in spite of the fact that the affective component in pain perception correlates significantly with somatisation[4] and hostility and the impairment of general health.

Several of the above studies do not distinguish between experimentally induced pain, where pure sensory data is measured, and perceived pain (clinical pain), which comprises pure sensory data as well as the patient's cognitive and affective processing of the pain. In addition, the experimental pain is an acute induction of pain, while BMS constitutes a chronic state of pain. From a psychological point of view these two conditions are not comparable. The decisive psychological factor of chronic pain is that is has an unpredictable time perspective. This may affect the mental state of a BMS patient and initiate reactions characterised by lack of control, meaninglessness, hopelessness, anxiety and depressive reactions. Thus, it does not seem appropriate to compare experimentally induced pain with perceived/clinical pain that involves a number of other components in addition to sensory data, e.g. pre-expectation and cognitive as well as affective processing of pain stimuli.

Psychogenic Factors and BMS

The complexity of BMS emphasises the difficulties related to first identifying psychogenic factors and then uncovering a possible causal relationship between those factors and BMS. The variations in study results may be due to differences in methodology and personality dispositions, including defence organisation and/or the coping profile of the individual BMS patient. The latter also affects the management of illness and thus may increase vulnerability in relation to developing depression and/or anxiety in relation to BMS[5]. At the same time it is likely that prolonged stress such as chronic pain conditions like BMS may affect and alter the patient's psychological level of functioning. Accordingly, BMS patients seem to benefit from psychodynamically oriented group therapy (Jerlang, 1993) or cognitive therapy (Bergdahl et al, 1995b; Humphris et al, 1996).

DIAGNOSIS

At present, BMS must be considered as an exclusion diagnosis in which a dental or medical cause has been excluded. The clinically normal appearance of the oral mucosa, which contrasts with the patient's pronounced complaints, and the time criterion constitute important factors in differential diagnosis (Zakrzewska et al, 2001). The examination of a patient with burning pain in the oral mucosa should begin by taking a detailed history regarding current symptoms (pain, dry mouth, taste, etc.), their intensity, character, location, onset and course. It would be appropriate to use a visual analogue scale and possibly combine it with standard questions for measuring the patient's pain intensity and degree of dry mouth. Information should be procured about the patient's current and previous health status, including chronic systemic disorders, allergies and immunological disorders, and previous and current medications. The history should also include information on previous or current psychosocial stress and its potential cause. The subsequent extraoral and intraoral examinations should include temporomandibular function, inspection and palpation of the masticatory muscles, inspection of the oral mucosa, tongue mobility and appearance, teeth and periodontium, and examinations of the design and function of any prosthetic dentures. Frequent supplementary examinations are dental panorama and intraoral X-rays, sialometry and possibly examinations of chemosensory mechanisms and tactile sense (van der Waal, 1990; Zakrzewska, 1995; Grushka et al, 2002). If the initial examinations revealed a need for supplementary assessment in the fields of haematology (in particular, vitamin deficiencies should be checked and eliminated), allergology, neurophysiology and/or psychology, this should be undertaken in cooperation with the patient's general practitioner, dental specialist and/or psychologist.

[4] Somatisation is defined as a tendency to feel and complain of physical symptoms and discomfort that cannot be explained by pathological findings, and to ascribe these to somatic illness and seek treatment thereof (Lipowski, 1988) and/or a tendency to experience and express stress in the form of physical symptoms.

[5] No studies are available on the defence organisation and/or coping profile of BMS patients, and the measurement of those concepts constitute a challenge regarding the methodology because of difficulties in measuring those concepts empirically.

THERAPEUTIC APPROACHES

The etiology and pathogenesis of BMS are still unknown, and a causal treatment is not available. Consequently, BMS treatment aims primarily at symptom relief, which may be difficult and sometimes even impossible (Tourne and Friction, 1992). Early intervention by information and/or psychological assessment[6] seems to be imperative for enhancing the patient's psychosocial level of functioning and preventing somatic overtreatment (van der Ploeg, 1987; van der Waal, 1990; Tourne and Friction, 1992; Jerlang, 1997).

It is important that the dentist working with BMS cooperates with the patient's physician, psychologist or a multidisciplinary pain clinic. The persistent and inexplicable burning pain in the oral cavity may trigger catastrophic thoughts in the patient, and some develop cancerophobia (Browning et al, 1987). This makes it important to inform the patient in detail about the syndrome, its nature and symptoms. It is also highly important that the dentist displays respect for the patient's situation. It has been shown that 88% of BMS patients feel inadequately informed about BMS by the health professionals (van der Ploeg, 1987). The patient may be very keen to eliminate chronic oral pain, and unfortunately dental overtreatment, including endodontic treatment and tooth extractions, is quite frequent (Hampf et al, 1987; Storb and Pliskin, 1991; Jerlang, 1993). Accordingly, dental treatment should aim at prevention. In those cases where the odontological examination is not reassuring, and where the psychosocial level of functioning is affected by the symptoms, the patient should be referred to a psychologist (Jerlang, 1993; Hakeberg et al, 2003).

SYSTEMIC MEDICAL TREATMENT WITH A CENTRAL EFFECT

Antidepressant Drugs

Both tricyclic and tetracyclic antidepressants have been used to treat BMS patients for many years. Originally, these drugs were prescribed because of the assumption that BMS was a primary psychogenic depressive disorder (Feinmann et al, 1984). Later it turned out that in addition to their blocking effect on the serotonin and noradrenalin reuptake mechanisms, cyclic antidepressants also have an independent analgesic effect (via monoamine-dependent pain modulating systems) (Loldrup et al, 1989). In low doses, tricyclic antidepressants affect the oral burning pain of BMS patients (Grushka et al, 2002). However, this assumption is based on anecdotal or clinical uncontrolled studies. Two clinical controlled studies are available which look at the effect of treating BMS patients with antidepressants, and both are included in a recent Cochrane review (Zakrzewska et al, 2001). One study comprised 253 patients with different idiopathic pain syndrome, who were treated in a double-blind study design with clomipramine (tricyclic antidepressant) and mianserin (tetracyclic antidepressant). No differences in pain relief were observed between the two antidepressants and placebo (Loldrup et al, 1989). The other placebo-controlled study showed that trazodone (Desyrel®, a weak serotonin reuptake inhibitor with effect on several neurotransmitters) had no effect on oral burning symptoms in BMS patients (Tammiala-Salonen and Forsell, 1999). A recent open, non-randomised study has compared the effect of selective serotonin reuptake inhibitors (SSRIs) with amisulpride (a selective dopamine D2/D3 antagonist) and found that the two types of drugs have equal effects on BMS (Maina et al, 2002). SSRIs have fewer anticholinergic side-effects than conventional cyclic antidepressants, but they should be further tested in a major clinical placebo-controlled study.

Benzodiazepines

In a clinical uncontrolled study, clonazepam (Rivotril®) in low doses (0.25–2 mg per day) reduced oral burning pain in 20% of 30 BMS patients, corresponding to a placebo-associated effect (Grushka, 1998). In a similar study, local treatment with clonazepam (compressed lozenge) was examined for effect, and symptom relief was reported in 52% of the patients (Woda et al, 1998). Clonazepam is a benzodiazepine derivative and shares the characteristic properties of this group, including a risk of tolerance and dependence and undesirable effects such as sedation, depression and lowered concentration. The exact mechanism of action of clonazepam is not known, but presumably it relates to its ability to bind to the $GABA_A$ (γ-aminobutyric acid) receptor complex, thereby increasing the sensitivity of this receptor to GABA, the most prevalent inhibitory neurotransmitter of the central nervous system. Accordingly, clonazepam indirectly increases $GABA_A$-ergic inhibitory neurotransmission, thereby possibly affecting the signal routes of taste and pain (Grushka et al,

[6] Psychological assessment involves the assessment of a number of psychological variables and their dynamic interaction. It could be called psychological diagnostics or described as the psychologist's endeavours to understand how each patient views and perceives the world. In this respect, the assessment differs from psychotherapy, which focuses on changes.

2002). The drug has a longer half-life than other benzodiazepines, and surprisingly it had a positive effect in some BMS patients on taste disturbances and the sensation of dry mouth (Grushka, 1998). Paradoxically, a more recent case has described BMS-like symptoms triggered by clonazepam therapy, which had been prescribed against episodes of anxiety. The patients' BMS symptoms ceased when the therapy was discontinued (Culhane and Hodle, 2001). Combination therapy with low-dosage clonazepam and gabapentin has been tried, but the effect was not confirmed in a controlled double-blind study (Grushka et al, 2002). Gabapentin is an anticonvulsant used increasingly to treat neuropathic pain of different etiology, but it remains open whether it is applicable in the treatment of BMS patients.

Local Medical Treatment

As mentioned previously, local analgesics have proved effective in BMS patients with abnormal winking reflex (Jääskläinen et al, 1997). A mouth rinse with a mixture of capsaicin from hot pepper (chilli) and water in the ratio 1:2 has also been tried for symptom relief in oral neuropathic pain, but the result is inconclusive (Epstein and Marcoe, 1994). The rationale behind the use of capsaicin, which is ostensibly tolerated by few patients (Grushka et al, 2002), is to bring about desensitisation of the polymodal type C nociceptors by first lowering the release and then promoting the reuptake of substance P (from sensory nerve-endings). Long-term treatment is expected to lead to depletion of substance P by provoking degeneration of the C fibres (Epstein and Marcoe, 1994). Local use of capsaicin in the oral cavity has not been examined in BMS patients in controlled clinical studies.

In a double-blind randomised study, mouth rinse with benzydamine hydrochloride (Andolex®) 0.15% three times daily for four weeks had no effect on the oral burning symptoms in BMS patients (Sardella et al, 1999). In a more recent clinical controlled study, treatment with the antioxidant α-lipoic acid, a mitochondrial enzyme, appeared to reduce the burning symptoms in two thirds of the BMS patients, which seemingly supports the theory that BMS is a form of neuropathy (Femiano and Scully, 2002).

Psychological Clinic

The present section is based on one of the author's (BBJ) many years of experience with BMS patients in the psychological clinic. BMS is characterised by the fact that, regardless of the varying characteristics of pain perception, the patients' reactions are remarkably similar from a psychological perspective, since the BMS patient is not able to distinguish between psychic and somatic discomfort. This becomes apparent from the fact that, even though the psychologist may identify psychosocial stressors in the patient's life, trauma-conditioned reactions, anxiety and/or depressive phenomena that seem to originate from other aspects of life, the patient does not recognise the psychological phenomena in other contexts than the somatic (physical) experience of pain. This does not preclude one or more somatic etiopathogenic factors, but it tells us that the patient is probably decoding somatic and psychological stimuli in the same way. In BMS patients, the chronic pain condition may produce fear of the future. This can be hard to distinguish from, for instance, an existential fear of growing old or of dying, where the anxiety precedes or potentates the pain. This way of perceiving things has the consequence that 'enhancers' in the form of, for example, conflicts or grief or depression may occur in relation to the somatic perception of pain. Potential covert psychic aspects like these will frequently require a psychological assessment in addition to the somatic one. This phenomenon may explain the substantial reduction in functionality and the despair often seen in BMS patients, and it may seem disproportionate considering that it is a benign condition with oral burning sensation. This clinical experience may also be explained by the presence of alexithymic traits in BMS patients (Jerlang, 1997). In the psychology practice, the concept of alexithymia means that BMS patients are not susceptible to individual explorative psychotherapy. This form of therapy would usually be too anxiety-provoking, since many BMS patients seem to have a preconceived fear of mental breakdown when facing psychologically 'unpleasant material' (Jerlang, 1993). The physical perception may thus function as a defence against inner breakdown. The psychotherapy talk group seems to hold some potential (Bergdahl et al, 1995b; Jerlang, 1993), although this form of therapy has not been tried by a sufficient number of BMS patients. The rationale behind this experience is presumably that in a group with other BMS patients, the anxiety provoked by confrontation with psychological discomfort/pain is compensated or alleviated by the community spirit that arises among the group members (Jerlang, 1993). Through this form of therapy, the BMS patient will be able to strengthen his or her level of functioning and to cope in spite of pain. Psychological assessment, typically comprising three to five sessions with a psychologist, often proves to have a positive effect *per se*, especially by minimising pathogenic behaviour, typic-

ally manifested as repeated appeals for treatment without any somatic foundation at the risk of overtreatment. BMS patients often harbour great and sometimes unrealistic expectations from the somatic health professional, which is another reflection of the physical perception of things. In practice, this positive projection can be put to positive use if the health professional is able to assume responsibility for effecting both the relevant somatic and psychological assessments. Studies based on limited data have stated that the best functioning BMS patients are those with good relations with their dentist or physician (Jerlang, 1993; Jerlang, 1997). At present, optimum management of BMS patients seems to be a scenario where interdisciplinary cooperation is structured with clear procedures and with a somatic professional in charge of management. A pain clinic would be a logical choice. The relevant somatic treatment provision should be implemented first. At the same time, the BMS patient should have the option to participate in a group focused on psychological pain therapy, if the patient's normal life routines are hampered. This type of pain group could also involve other types of patients with pain. The general message is to make it legitimate and relevant for the patient to participate in an assessment of the psychological aspects and in terms of being a chronic pain patient.

CONCLUSIONS

Several studies of potential etiological and pathogenic factors including somatic and/or psychological factors have been carried out without providing an unambiguous picture of the chronic orofacial pain condition known as BMS. An interdisciplinary pain clinic would be a suitable forum, not just for unifying the diagnostic and therapeutic approaches, but also for further research in the syndrome. There is no doubt that innovative and interdisciplinary research would expand the knowledge of the basic etiological and pathogenic factors involved in BMS. In the long term, it should also enhance the number of evidence-based treatment options.

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