available at www.sciencedirect.com

ScienceDirect

journal homepage: http://www.elsevier.com/locate/aob

Xerostomia and salivary flow in patients with orofacial pain compared with controls

Luciana A. da Silva [a], *Manoel J. Teixeira* [b], *Jose T.T. de Siqueira* [c], *Silvia R.D.T. de Siqueira* [d,*]

[a] *Neurology Department, Medical School, University of Sao Paulo, Sao Paulo, Brazil*
[b] *Interdisciplinary Pain Center, Hospital das Clinicas and Neurology Department, Medical School, University of São Paulo, Sao Paulo, Brazil*
[c] *Orofacial Pain Team, Dentistry Division, Hospital das Clínicas, Medical School, University of São Paulo, Sao Paulo, Brazil*
[d] *R Dr Eneas de Carvalho Aguiar, 255 - 5o andar - 05403000 Sao Paulo, Brazil*

ARTICLE INFO

Article history:
Accepted 3 April 2011

Keywords:
Xerostomia
Salivary flow
Orofacial pain
Burning mouth

ABSTRACT

Objectives: Pain in the orofacial region is frequently reported by patients in dental and medical offices. Facial pain, headache, masticatory abnormalities and other complaints often become chronic and may be associated with local disturbances, such as xerostomia and teeth abnormalities. The objective of this study was to investigate salivary flow and xerostomia in patients with orofacial pain.

Design: This was a case-control study; we evaluated 82 patients with chronic orofacial pain compared with 56 healthy subjects using a Clinical Pain Questionnaire (pain characteristics, duration, intensity and descriptors), complete dental examination (including static and dynamic evaluation of the jaw) and a Xerostomia Inventory. The salivary flow was quantitatively evaluated. Data was compared through Pearson's chi-square, Fisher's exact, analysis of variance (ANOVA) 1 factor and Mann–Whitney tests.

Results: Patients often had temporomandibular disorder (TMD) ($P = 0.001$) and pain during facial ($P < 0.001$) and neck palpation ($P = 0.002$). There were no differences in dental examination or other structural aspects of the jaw between the groups. There were more complaints associated with xerostomia in the study group, including burning sensation in the oral mucosa ($P = 0.003$), in the throat ($P = 0.035$) and in the stomach ($P = 0.050$). Patients had lower salivary flow ($P = 0.008$).

Conclusions: Orofacial pain patients need to be evaluated with regard to their salivary function, which was often found abnormal in this sample and may have contributed to the complaints of these patients. Assessing salivary flow and xerostomia may help in the treatment of chronic orofacial pain.

Saliva has an important role in the protection of the oral tissues and the gastroenteric epithelium, and its absence or alteration can cause many significant problems.[1,2] Amongst its functions, it facilitates the formation of the bolus, swallowing, phonation and the retention of complete dentures; it also prevents the damage of soft and hard tissues in the oral cavity by mechanical, chemical or biological noxious stimuli.[3] Saliva contains a variety of electrolytes, peptides, glycoprotein, enzymes, immunoglobulin A,[4] growing factors, amines[5] and leucocytes,[2] and amongst its properties, the buffering effect prevents the demineralisation of the teeth.[6]

* *Corresponding author*. Tel.: +55 11 91842878.
E-mail address: silviadowgan@hotmail.com (Silvia R.D.T. de Siqueira).
0003–9969
doi:10.1016/j.archoralbio.2011.04.001

Xerostomia means the subjective sensation of dry mouth; it can be evaluated by individual questionnaires, salivary tests and sialometry, which can confirm the presence of lower salivary flow or altered composition, associated or not with the complaint.[7,8] It can be caused by systemic diseases (e.g., Sjögren syndrome, diabetes and hypothyroidism),[9–12] emotional stress, abuse of drugs, human immunodeficiency virus (HIV) infection,[13] radiation of the head and neck[14] or chronic use of several medications.[15,16] The reduction of the salivary flow causes many consequences that affect oral and the general health. The most common complaints are discomfort and burning sensation,[17] caused by the dryness of the oral mucosa and the difficulty of feeding.[18] There are also taste loss, bad breath[19] and difficulties in swallowing, talking[20] and using prostheses.[21] Opportunist oral infections, such as candidiasis, or dental problems (caries and periodontitis) may occur.[22]

Orofacial pain occurs at least once in a lifetime for 70% of the people.[23] Amongst the causes, dental pain and temporomandibular disorders (TMDs) are the most frequent.[24,25] Dental pain is often inflammatory and causes intense central sensitisation.[26] TMD includes articular and muscular diseases involving the masticatory system.[24] Neuropathic pain syndromes are also common in the face, and they may be associated with TMD or odontalgia.[27] There is a lack of studies investigating salivary complaints in individuals with orofacial pain; however, such abnormalities might contribute to the oral discomfort of these patients. Thus, the objective of this study was to investigate salivary flow and xerostomia in patients with orofacial pain.

1. Materials and methods

1.1. Patients

We enrolled 112 consecutive patients with orofacial pain who had been referred to the Neuropathic Facial Pain Clinic of the Functional Neurosurgery Division, Psychiatry Institute, Hospital das Clinicas, Medical School, University of Sao Paulo, Brazil. They comprised all patients who were referred to evaluation between May 2009 and April 2010. The criteria included facial pain complaints for at least the last 6 months, no diagnosis of generalised pain (e.g., rheumatoid arthritis and fibromyalgia) and agreement to participate in the study. Thirty patients were excluded because they did not fulfil the criteria; 82 were left. Patients were diagnosed according to the criteria of the International Headache Society (2004).[28] Thirty-two patients had secondary diagnoses.

Fifty-six normal subjects were included in the control group of this study; all of them had no history of facial or generalised pain in the last 6 months. All patients and controls were informed about the purposes of the study, and all signed the informed consent. The protocol had been approved by the local Ethics Committee. Demographic data were compared using Pearson's chi-square test (Statistical Package for Social Sciences (SPSS) 17.0; SPSS Inc., IL, USA) and can be observed in Table 2. There was a sex difference between the groups. Twenty-seven (32.9%) patients and 13 (23.2%) controls were accompanied by relatives, mostly spouses and sons/daughters; 64 patients (78.0%) and 29 controls (69.6%) were on chronic medication ($P > 0.050$). Amitriptyline was the most common medication in the patient group (29; 35.3%), followed by carbamazepine (22; 26.8%), anti-hypertensive drugs (13; 15.9%), common analgesics (four; 4.9%) and others (12; 14.6%). Anti-hypertensive drugs were the most common medication in the control group (30; 53.6%). There was a difference between groups in relation to the use of antidepressants and anti-hypertensive drugs ($P < 0.001$).

1.2. Instruments for orofacial evaluation

The questionnaires and exams were performed only by one researcher, who ensured clear understanding of the content by the participants before starting the protocol.

All subjects underwent a standardised protocol for the evaluation of the orofacial region, including main complaint, pain characteristics (location, quality, duration, descriptors, intensity by the visual analogue scale – VAS, causal, alleviation and aggravation factors), medical history and medications, earache, headache, generalised body pain and sleep disturbances.[29] All questions were open and included all answers reported by the patient, validated for the diagnosis of orofacial pains.[29] Masticatory complaints, parafunctional habits and laterality and quality of mastication were also investigated. The diagnosis of TMD was based on symptoms and physical exam following the criteria of the International Headache Society.[24]

1.3. Dental exam

The dental exam included the static and dynamic evaluation of the dentition as well as signs of oral habits. Missing teeth replaced or not by dentures, decays and movement parameters of the jaw (interocclusal distances, protrusion and right and left laterality) were observed. Pain from mandibular movements, articular noises at the temporomandibular joints (TMJs) and muscular palpation of the head and neck (bilateral masseters, temporalis, digastrics, sternocleidomastoid, trapezius, splenius and suboccipitals) were also evaluated, as well as the clinical aspects of the oral mucosa and tongue; periodontal tissues were examined with periodontal probes and classified according to the criteria of the American Academy of Periodontology.[30,31]

1.4. Xerostomia and oral mucosa complaints

Oral complaints and xerostomia were assessed by the Xerostomia Inventory validated to the Portuguese language.[11] This questionnaire includes the investigation of dry-mouth sensation, difficulties in oral functions due to loss of saliva, halitosis, subjective sensation of dry skin, dry eyes or dry nose, burning mouth, pharynx, stomach and intestine complaints and, finally, the quality of digestion, through a ''yes''/''no'' question for each of the symptoms listed earlier.

1.5. Quantitative salivary evaluation

All patients were oriented to fast for 2 h before the exam, and should not have smoked or chewed gum on the day of the exam. Initially, two wads of cotton were placed in a plastic pot

(80 ml) and weighed on a precision scale (Acculab® V1200). After the patients had swallowed all saliva, the wads were placed on the mouth floor, under the tongue, for 5 min. During this period, the patient should not swallow. After that, the cotton wads were removed and put back into the plastic pot for weighing again. The difference between the values was considered and divided by 5, so that the salivary flow was obtained in g min^{-1}.[32]

1.6. Data analysis

Means, standard deviations and frequencies were computed to summarise the distribution of values for each variable. After the initial descriptive evaluation, variables were tested in relation to the normal distribution with the Shapiro–Wilk test and Q–Q plots. The use of medication and the period of the day in which the evaluation was done (morning, afternoon or evening) were considered in the analysis of salivary flow. Non-parametric tests included Pearson's chi-square, Fisher's exact, analysis of variance (ANOVA) 1 factor and Mann–Whitney tests. The coefficient of Spearman was used for correlations. The level of significance was 5%.

2. Results

The groups were different as regards gender distribution but similar in ages, colour, marital status, occupation, height, weight, co-morbidities, smoking habits and subjective smell and taste complaints. There were more women in the study group (79.3%) when compared with the control group (57.1%) ($P = 0.005$).

2.1. Orofacial evaluation

There was a high intensity of pain by the VAS (8.01 ± 2.72), which was often daily and spontaneous (66–80.5%); the most common pain descriptor was shock-like (34–41.5%); medication was the most common alleviation factor (33–40.2%); and the pain usually had a spontaneous start (48–40.8%). The mean duration of pain was 5.95 ± 6.60 months (range from 0 to 30 months). The diagnoses of orofacial pain are outlined in Table 1.

Table 1 – Study group: orofacial pain diagnoses ($N = 82$).

		N	%
Primary diagnosis	Trigeminal neuralgia	32	39.0
	Burning mouth syndrome	14	17.1
	Atypical facial pain	9	11.0
	Temporomandibular disorder	8	9.8
	Post-traumatic neuralgia	6	7.3
	Post-herpetic neuralgia	6	7.3
	Wallemberg syndrome	3	3.7
	Facial palsy	3	3.7
	Cervicogenic headache	1	1.1
Secondary diagnosis	Temporomandibular disorder	28	34.1
	Shwanoma/meningioma	2	2.4
	Cervical myofascial pain	2	2.4

In the study group, a higher frequency of TMD ($P = 0.001$), worse quality of mastication ($P < 0.001$), higher frequency of fatigue in the face ($P = 0.047$) and higher pain in mandibular movements ($P = 0.015$), as well as in facial ($P < 0.001$) and neck palpation ($P = 0.002$), were observed (Table 2). The groups did not differ in parafunctional habits, complaints of pain whilst awakening, articular noises and headache.

2.2. Dental exam

The dental exam (use of dental prosthesis, dental occlusion, periodontal, teeth, tongue and mucosa characteristics) did not show statistical differences between the groups; however, mastication complaints were more frequent in the study group ($P = 0.002$).

2.3. Salivary flow, xerostomia and associated variables

The differences with regard to xerostomia and associated complaints can be observed in Table 3. The study group presented more discomfort at the oral cavity, abnormal saliva, dry-mouth sensation, difficulty of chewing due to xerostomia, loss of taste due to xerostomia, change in the taste of food, need of liquids to swallow, avoiding food due to xerostomia, use of drinks other than water during the day, dry-eyes' sensation, burning sensation at the mouth, sensation of secretion at the throat, throat pain, avoiding the use of dentures, difficulty in the use dentures at night due to xerostomia and burning at stomach. There were no differences between the groups in relation to: difficulty in swallowing saliva, difficulty in talking due to xerostomia, dry-mouth sensation during meals, need for drinking water during the night or chewing gum or eating sweets due to dry-mouth sensation, number of glasses of water during the day, abnormal taste, bad breath, sensation of dry vagina in women, sensation of dry skin, sensation of dry nose, stuffy nose, normal function of the intestines, quality of digestion or difficulties with digestion. It was also observed that the salivary flow in patients was lower when compared with the controls ($P = 0.008$) (Fig. 1).

No correlations were observed amongst the variables. The patients who used medications (antidepressants and/or anti-hypertensive drugs) complained more about dry mouth ($P = 0.007$); however, it was not associated with a reduced salivary flow ($P = 0.338$). The doses of medications were not investigated.

3. Discussion

This study showed that patients with orofacial pain had lower salivary flow and more complaints of xerostomia than controls. These complaints included abnormalities in mastication, difficulties in wearing prostheses and discomfort and pain in the oral mucosa and the gastroenteric tract. Saliva may be playing a role in these findings as a consequence of or a co-existing factor with chronic orofacial pain.

The high prevalence of dental prostheses and periodontal infections in this sample corresponded to the expectation in our population (Brazilian Health Ministry, 2003). However, the

Table 2 – Comparison of general and orofacial complaints between the study and control groups (N = 138).

	Study group (N = 82)	Control group (N = 56)	P*		
Quality of mastication	Good	33 (40.2%)	Good	47 (83.9%)	<0.001
	Bad	25 (30.5%)	Bad	7 (12.5%)	
	Terrible	15 (18.3%)	Terrible	2 (3.6%)	
	Painful	5 (6.1%)	Painful	0 (0.0%)	
	Other	4 (4.9%)	Other	0 (0.0%)	
Fatigue at face	Whilst chewing	7 (8.5%)	Spontaneous	4 (7.1%)	0.047
	In all jaw movements	7 (8.5%)	When stressed	1 (1.8%)	
	Whilst awakening	6 (7.3%)	Whilst awakening	1 (1.8%)	
	Whilst talking	5 (6.1%)	Whilst talking	0 (0.0%)	
	Constant	3 (3.7%)	Constant	0 (0.0%)	
Pain in mandibular movements	All movements	15 (18.3%)	All movements	1 (1.8%)	0.015
	Mouth opening	11 (13.4%)	Mouth opening	1 (1.8%)	
	Laterality	3 (3.7%)	Laterality	1 (1.8%)	
TMD[a]	36 (43.9%)	2 (3.6%)	0.001		
Pain at facial palpation	All masticatory muscles	26 (31.7%)	All masticatory muscles	0 (0.0%)	<0.001
	Masseter and temporalis	18 (22.0%)	Masseter and temporalis	2 (3.6%)	
	Masseter	14 (17.1%)	Masseter	12 (21.4%)	
Neckache	32 (39.0%)	7 (12.5%)	0.002		
Mastication complaints	Pain	21 (25.6%)	Pain	1 (1.8%)	0.002
	Old dentures	5 (6.1%)	Old dentures	3 (5.4%)	
	Absence of teeth	3 (3.7%)	Absence of teeth	0 (0.0%)	
	Fatigue whilst chewing	5 (6.1%)	Fatigue whilst chewing	1 (1.8%)	

* Pearson's chi-square; Fisher's exact test.
[a] Temporomandibular disorder.

patients showed more difficulties when wearing their prostheses (Table 3). This could be explained at least, in part, by the reduced salivary flow observed in this study. Saliva plays a role in the retention of dentures in the oral mucosa; it also protects the oral tissues from the frequent injuries that they are exposed to, and its absence can even impair digestion and nutrition.[1,2] It is important for the sensorial perception of gustation, and, in fact, we observed an association between its abnormalities and taste disturbances. Taste is a complex sensory function that depends on the integration of several sensorial modalities in central areas of the nervous system involving gustation, olfaction, the temperature of food and tactile information, such as texture and consistence. Particularly in the group of patients with neuropathic pain, especially burning mouth syndrome (BMS), the altered somatosensory transduction could contribute to the primary diagnosis of BMS, which has been extensively discussed in the literature,[33–36] including by our group.[37]

Salivary flow was altered not only in the group of BMS, but in all patients with orofacial pain evaluated in this study. The reasons for this are not clear, and one hypothesis could be the involvement of sensitised interneurons between pain pathways and the neurovegetative areas of the hypothalamus in chronic pain processes. Tearing and increase of nasal mucus

Table 3 – Comparison of xerostomia and associated complaints between the study and control groups (N = 138).

	Study group (N = 82)	Control group (N = 56)	P*
Discomfort at the oral cavity	60 (73.2%)	8 (14.3%)	<0.001
Abnormal saliva	30 (36.6%)	11 (19.6%)	0.024
Dry mouth sensation	45 (54.9%)	22 (39.3%)	0.050
Difficulty of chewing due to xerostomia	11 (13.4%)	2 (3.6%)	0.045
Loss of taste due to xerostomia	24 (29.3%)	6 (10.7%)	0.007
Change in the taste of food	16 (19.5%)	4 (7.1%)	0.034
Need of liquids to swallow	17 (20.7%)	5 (8.9%)	0.050
Avoiding food due to xerostomia	8 (9.8%)	0 (0.0%)	0.013
Use of other drinks than water during the day	59 (72.0%)	48 (85.7%)	0.043
Dry eyes sensation	32 (39.0%)	13 (23.2%)	0.038
Burning sensation at the mouth	24 (29.3%)	5 (8.9%)	0.003
Sensation of secretion at the throat	32 (39.0%)	13 (23.2%)	0.038
Throat pain	18 (22.0%)	5 (8.9%)	0.035
Avoiding the use of dentures	52 (63.4%)	24 (42.9%)	0.014
Difficult to use dentures at night due to xerostomia	4 (4.9%)	1 (1.8%)	0.034
Burning at stomach	30 (36.6%)	10 (17.9%)	0.050

* Fisher's exact test.

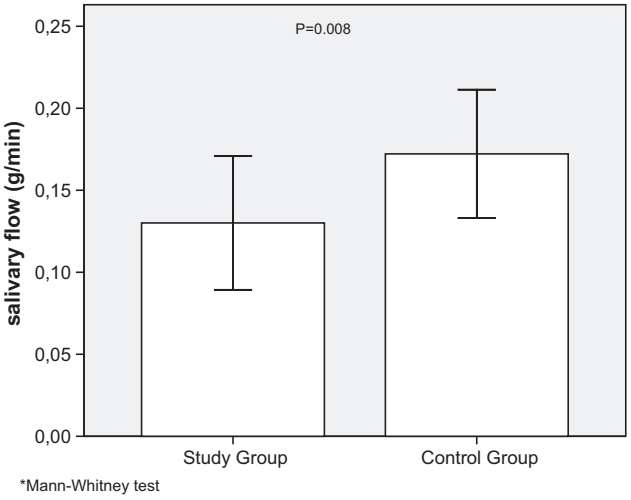

Fig. 1 – Comparison of salivary flow between the study and control groups: interquartile range and medians (N = 138).

are often observed in chronic headaches.[23] These findings could also be associated with the use of chronic medications that can interfere with salivary flow, especially antidepressants, but, in this study, the use of these medications was not associated with the reduction of saliva, but only with the dry-mouth complaints. We did not evaluate the doses of these medications. It is important to consider that patients with higher doses of antidepressants could have lower salivary flow, which could have interfered with our results, and therefore needs further investigation. Other important factors that were not evaluated and may interfere with saliva production are anxiety and depression, which were not investigated in this sample. These are often associated with chronic-pain patients.

The characteristics of pain observed in this study corresponded to the expected according to the diagnoses of the patients; the most common diseases were neuropathic (trigeminal neuralgia, BMS and atypical facial pain) and corresponded to the nature of the clinic (neuropathic facial pain clinic). However, TMD was a common secondary diagnosis; previously, it was also observed that TMD was prevalent in patients with trigeminal neuralgia[27]; its association with other chronic neuropathic pain may involve central sensitisation, neurogenic inflammation and peripheral activation of muscles at the trigeminal complex.

Patients who had orofacial pain presented worse quality of mastication ($P < 0.001$), higher pain in mandibular movements ($P = 0.015$), higher pain during the muscular palpation of the face ($P < 0.001$) and neck ($P = 0.002$) and more masticatory complaints ($P = 0.002$). Pain itself has probably interfered with the mandibular activities, and these findings also support the high frequency of TMD in this sample. Amongst risk factors for TMD, bruxism was commonly observed, but the groups did not statistically differ. Bruxing or clenching the teeth causes an overload on the masticatory muscles and can precipitate TMD.[38]

Limitations of this study are the design, which does not allow the investigation of cause–effect associations, and a higher frequency of women in the study group. Chronic pain is more frequent in the female gender,[24] and it might have interfered with the results observed. Doses of antidepressants and anti-hypertensive drugs, which were not investigated, may also have underlain, at least in part, the results as to lower salivary flow in the study group.

In conclusion, orofacial pain patients need to be evaluated in regard to their salivary function. They had lower salivary flow and more xerostomia complaints than the controls, which can cause discomfort and effectively contribute to pain.

Funding

This study was supported by FAPESP (Foundation of Research of the State of Sao Paulo, 2009/00350-6).

Competing interest

None declared.

Ethical approval

This study was approved by the Ethics Committee of the Hospital das Clinicas, Medical School, University of Sao Paulo, Brazil (0901/2008).

Acknowledgements

We would like to acknowledge Raphael Sa, Rodrigo Primiceri da Silva and Maira Caracas for their participation in the study.

This study was supported by FAPESP (Foundation of Research of the State of Sao Paulo, 2009/00350-6).

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.archoralbio.2011.04.001.

REFERENCES

1. Fox PC, Brennan M, Pillemer S, Radfar L, Yamano S, Baum BJ. Sjogren's syndrome: a model for dental care in 21st century. *J Am Dent Assoc* 1998;**29**:719–28.
2. Rayman S, Dincer E, Almas K. Xerostomia. Diagnosis and management in dental practice. *N Y State Dent J* 2010;**76**(2):24–7.
3. Song Q, Lange T, Spahr A, Adler G, Bode GJ. Characteristic distribution pattern of *Helicobacter pylori* in dental plaque and saliva detected with nested PCR. *J Med Microbiol* 2000;**49**:349–53.
4. Rivera V, Hernández D, Rojas S, Oliver G, Serrano J, Shibayama M, et al. IgA and IgM anti-*Naegleria fowleri* antibodies in human serum and saliva. *Can J Microbiol* 2001;**47**(5):464–6.
5. Lee YH, Wong DT. Saliva: an emerging biofluid for early detection of diseases. *Am J Dent* 2009;**22**(4):241–8.

6. Tschoppe P, Wolgin M, Pischon N, Kielbassa AM. Etiologic factors of hyposalivation and consequences for oral health. *Quintessence Int* 2010;**41**(4):321–33.
7. Ghezzi EM, Ship JA. Aging and secretory reserve capacity of major salivary glands. *J Dent Res* 2003;**82**(10):844–8.
8. Thomson WM. Issues in the epidemiological investigation of dry mouth. *Gerontology* 2005;**22**:65–76.
9. Atkinson JC, Wu AJ. Salivary gland dysfunction: causes, symptoms, treatment. *J Am Dent Assoc* 1994;**125**(4):409–16.
10. Friedlander AH. The physiology, medical management and the oral implications of menopause. *J Am Dent Assoc* 2002;**133**(1):73–81.
11. Korn GP, Pupo DB, Quedas A, Filho IB. Correlation between xerostomia degree and sialometry in patients with Sjogren Syndrome. *Rev Bras Otorrinolaringol* 2002;**68**(5):1–2.
12. Garcia ER, Padilla AM, Romo SA, Ramírez MAB. Oral Mucosa symptoms, signs and lesions, in end stage renal disease and non-end stage renal disease diabetic patients. *Med Oral Pathol Oral Cir Bucal* 2006;**11**(6):467–73.
13. Gileva OS, Sazhina MV, Gileva ES, Efimov AV, Scully C. Spectrum of oral manifestations of HIV/AIDS in the Perm region (Russia) and identification of self-induced ulceronecrotic lingual lesions. *Med Oral* 2004;**9**(3):212–5.
14. Deasy JO, Moiseenko V, Marks L, Chao KS, Nam J, Eisbruch A. Radiotherapy dose–volume effects on salivary gland function. *Int J Radiat Oncol Biol Phys* 2010;**76**(Suppl. 3):S58–63.
15. Moore PA, Guggenheimer J. Medication-induced hyposalivation: etiology, diagnosis, and treatment. *Compend Contin Educ Dent* 2008;**29**(1):50–5.
16. Ciancio SG. Medications' impact on oral health. *J Am Dent Assoc* 2004;**135**(10):1440–8. (quiz 1468–1469).
17. Nasri C, Teixeira MJ, Okada M, Formigoni G, Heir G, Siqueira JT. Burning mouth complaints: clinical characteristics of a Brazilian sample. *Clinics (Sao Paulo)* 2007;**62**(5):561–6.
18. Dirix P, Nuyts S. Evidence-based organ-sparing radiotherapy in head and neck cancer. *Lancet Oncol* 2010;**11**(1):85–91.
19. Bromley SM. Smell and taste disorders: a primary care approach. *Am Acad Family Physicians* 2000;**61**(2).
20. Carsons SMD. A review and update of Sjögren' s syndrome manifestations, diagnosis and treatment. *Am J Manag Care* 2001;**7**(14):433–43.
21. Sutcliffe N. Sjogren's syndrome. *Medicine* 2006;**34**(11):476–9.
22. Hernandez YL, Daniels TE. Oral candidosis in Sjogren's syndrome: prevalence, clinical correlations and treatment. *Oral Surg Oral Med Oral Pathol* 1989;**68**:324–9.
23. Teixeira MJ, Corrêa CF. *Pimenta CAM. Pain – general concepts. First study on pain*. 1 ed. São Paulo: Limay; 1994.
24. Dworkin SF, LeResche L. Research diagnostic criteria for temporomandibular disorders: review, criteria, examinations and specifications, critique. *J Craniomand Disord* 1992;**6**(4):301–55.
25. Doreyat J, Jaafar N. Impact of orofacial pain and discomfort in 16–17 yrs-old children in Johor. *J Dent Res* 1998;**77**:1350.
26. Sessle BJ. Acute and chronic craniofacial pain: brainstem mechanisms of nociceptive transmission and neuroplasticity, and their clinical correlates. *Crit Rev Oral Biol Med* 2000;**11**(1):57–91.
27. Siqueira SR, da Nóbrega JC, Teixeira MJ, de Siqueira JT. Masticatory problems after balloon compression for trigeminal neuralgia, a longitudinal study. *J Oral Rehabil* 2007;**34**(2):88–96.
28. International Headache Society Classification Subcommittee. International classification of headache disorders, 2nd ed.. *Cephalalgia* 2004;**24**(Suppl. 1):1–160.
29. Siqueira JTT, Ching LH, Nasri C, Siqueira SRDT, Teixeira MJ, Heir G, et al. Clinical study of patients with persistent orofacial pain. *Arq Neuropsiquiatr* 2004;**62**(4):988–96.
30. Parameter on chronic periodontitis with slight to moderate loss of periodontal support. *J Periodontol* 2000;**71**:853–5.
31. Parameter on chronic periodontitis with advanced loss of periodontal support. *J Periodontol* 2000;**71**:856–8.
32. Pupo DB, Bussoloti Filho I, Liquidato BM, Korn GP. Proposal of a pratical method of sialometry. *Rev Bras Otorrinolaringol* 2002;**68**(2):219–22.
33. Eliav E, Kamran B, Schaham R, Czerninski R, Gracely RH, Benoliel R. Evidence of chorda tympani dysfunction in patients with burning mouth syndrome. *J Am Dent Assoc* 2007;**138**(5):628–33.
34. Femiano F. Damage to taste system and oral pain: burning mouth syndrome. *Minerva Stomatol* 2004;**53**(9):471–8.
35. Femiano F, Lanza A, Buonaiuto C, Gombos F, Cirillo N. Burning mouth disorder (BMD) and taste: a hypothesis. *Med Oral Patol Oral Cir Bucal* 2008;**13**(8):E470–4.
36. Formaker BK, Frank ME. Taste function in patients with oral burning. *Chem Senses* 2000;**25**(5):575–81.
37. Siviero M, Teixeira MJ, Siqueira JTT, Siqueira SRDT. Somesthetic, gustatory, olfactory function and salivary flow in patients with trigeminal neuropathic pain. *Oral Dis* 2010;**16**(5):482–7.
38. Camparis CM, Siqueira JT. Sleep bruxism: clinical aspects and characteristics in patients with and without chronic orofacial pain. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod* 2006;**101**(2):188–93.