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ORIGINAL ARTICLE

Evaluation of palatal saliva flow rate and oral manifestations in patients with Sjögren's syndrome

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OBJECTIVE: The purpose of this study was to describe the oral properties of Sjögren's syndrome (SS), including the determination of palatal saliva (PS) flow rate.

SUBJECTS AND METHODS: Forty-nine SS patients and 43 healthy controls participated. Subjective symptoms were recorded and clinical assessments of the oral mucosal, dental and periodontal status were made. Unstimulated whole saliva (WS) and PS flow rates, the number of decayed, missing and filled teeth (DMF-T number), the gingival bleeding index (GBI) and the periodontal probing depth (PPD) were determined.

RESULTS: Despite the decrease in the flow rate of WS in SS patients, PS was not different from those of the controls (1.57 ± 1.02 and 1.35 ± 2.5 μl cm^{-2} min^{-1}, respectively). GBI (20.0% vs. 10.5%, respectively), DMF-T (27.1 ± 6.12 vs. 23.0 ± 6.99, respectively) and PPD (2.28 ± 1.09 mm vs. 1.82 ± 0.73 mm, respectively) were higher in SS compared with the controls ($P < 0.05$). DMF-T and PPD showed a positive correlation with anti-SSA and/or anti-SSB antibody positivity in the serum ($P < 0.05$).

CONCLUSIONS: Data of the present study suggest that the subjective feeling of xerostomia in SS patients is the result of a decrease in the volume of the whole saliva, and not of the viscous PS. Correlation of DMF-T and PPD with autoantibody positivity reveals that the oral health status of SS patients may be associated with the general autoimmune process.

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Keywords: Sjögren's syndrome; minor salivary glands; hyposalivation; denture-related symptoms

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Introduction

Sjögren's syndrome (SS) is an autoimmune, chronic inflammatory disease, which mainly affects the exocrine glands. It is oftentimes referred to as an 'autoimmune exocrinopathy' (Fox and Speight, 1996). Disturbed and diminished function of the lachrymal and salivary glands may, respectively, lead to the subjective feeling of dryness of the eyes and/or the mouth. The impaired exocrine function is the result of a focal, periductal, mononuclear cell infiltrate in the affected gland and the subsequent loss of its secretory epithelial cells. As a consequence, major changes occur both in the flow rate and in the composition of saliva, (Daniels and Fox 1992).

Ship *et al* (1991) reported that xerostomia, *per se*, is not always accompanied by a reduced saliva flow rate. Moreover, the absence of oral dryness does not necessarily mean that there is adequate salivary secretion (Ship *et al*, 1991). The role of the minor salivary glands is obvious in the physiology and pathology of the oral cavity. About 5–8% of the whole resting saliva is derived from the minor glands. The lowest flow rate is observed in the palatal glands. Collins and Dawes (1987) reported that oral dryness is dependent on the volume of a thin film of saliva, which is present on the oral mucous membranes and on the rate of the evaporation from these surfaces. The mucosa is covered with the least amount of saliva in the regions of the palate and the upper lip (Collins and Dawes, 1987). Moreover, the hard palate contains few minor salivary glands and it is an area of high evaporation (Dawes, 1987). Shern *et al* (1990) measured the palatal saliva (PS) flow rate in healthy individuals by the micro moisture meter device (PERIOTRON, HARCO Ltd, Winnipeg, Canada). According to their findings, the unstimulated flow rate was 0.74 μl cm^{-2} min^{-1} and that was not affected by a single application of the gustatory (citric acid) stimulant.

Wolff and Kleinberg (1998) reported that in patients with abnormally low unstimulated whole saliva (WS) flow rates (≤0.1 ml min^{-1}) the thickness of the palatal

fluid film is < 4–5 μm. On the contrary, in subjects with a normal WS flow rate the thickness varies between 14 and 18 μm. Their findings strongly suggest that the desiccatory status of the hard palate is a prominent indicator of oral dryness. The onset of dryness, they allege, corresponds to a saliva thickness of 10 μm or less on the posterior hard palate (Wolff and Kleinberg, 1998). According to these data, PS film thickness, and therefore xerostomia, depends mainly on the unstimulated WS flow rate, but there is no information about the influence of PS flow rate on it. Thus PS flow rate might also be an important factor of xerostomia and consequently the decrease in palatal film thickness.

Additionally, it has been demonstrated that the retention of the maxillary complete denture is not influenced by the WS flow rate (Niedermeier and Kramer, 1992). Rather, the patients complain about discomfort and pain in connection with denture wearing.

Many authors have studied the oral condition of patients with SS. However, only a few investigations have examined and quantified changes in the oral condition in a complex way (Table 1). Furthermore, no studies are available related to the PS flow rate in patients with SS.

The objectives of this present investigation were to determine the flow rates of unstimulated WS and PS and to determine the relationship between the flow rate of PS and subjective feeling of xerostomia. A further aim was to assess the oral and dental changes observed in patients with SS, including subjective symptoms, the status of the teeth, the condition of the periodontium, the use of dentures, and the clinical signs of the disease.

Materials and methods

Subjects

The study included 49 patients (46 women and three men) between the age of 32 and 76 years who were referred to the outpatient clinic of the 3rd Department of Internal Medicine, University of Debrecen, Hungary. All the patients fulfilled the revised diagnostic criteria for primary SS proposed by the American-European Consensus Group (Vitali *et al*, 2002). The clinical and laboratory data and the associated diseases of the patients were evaluated with the aid of a standard protocol, which was set up in the Division Of Clinical Immunology, 3rd Department of Internal Medicine, Medical and Health Science Center, University of Debrecen (Table 2). Lachrymal flow rate and the presence or absence of keratoconjunctivitis sicca was determined by the Schirmer's test and the Tear Break Up Time (TBUT). A histopathologic evaluation was also performed and serum autoantibody levels were determined. Biopsies of the lower lip of all patients with SS were taken. A light microscopic assessment of the

Table 1 Oral findings of different authors in patients with Sjögren's syndrome (SS)

Author	*Periodontal probing depth in controls*	*Periodontal probing depth in SS patients*	*Dental condition (DMF-T) in controls*	*Dental condition (DMF-T) in SS patients*	*Plaque/oral hygiene (SS)*	*Gingival bleeding/gingivitis index (SS)*
Tseng *et al* (1990)	–	3.02 mm, no significant periodontal disease	–	–	Plaque Index: 0.5	Bleeding: 0.21 GI: 0.98
Baudet-Pommel *et al* (1994)	–	–	–	*M*[a] correlated with focus score	–	–
Najera *et al* (1997)	–	Deeper[a], but no periodontitis	–	Higher caries incidence[a]	Indexes are increased	–
Celenligil *et al* (1998)	0.5 mm	3 mm[a]	*M* score 5	*M* score 15[a]	Plaque Index[a]	Sulcular bleeding[a]
Pedersen *et al* (1999)	2.5 mm	3 mm[a]	DMF-T: 16 *M* not different	DMF-T: 24[a] *D* score correlated with antibody and/or focus score	No difference compared with controls	No difference compared with controls
Ravald and List (1998)	–	No difference compared with controls	*M* 16	*M* score 17, *D* and *F* surfaces higher[a]	–	–
Schiodt *et al* (2001)		No difference compared with controls	–	–	Plaque: no difference, calculus higher compared with controls	No difference compared with controls
Kuru *et al* (2002)		No difference compared with controls	–	–	No difference compared with controls	No difference compared with controls

SS, Sjögren's syndrome; *D*, number of 'decayed' teeth; *M*, number of 'missing' teeth; *F*, number of 'filled' teeth.
[a]Indicates statistically significant increases in SS patients compared with controls.

Table 2 Clinical profile of 49 patients with Sjögren's syndrome

Age (mean ± s.d., years)	55 ± 11	49 ± 15
Positive focus score in minor salivary glands	36	–
Autoantibodies to Ro (SS-A)	41	–
Autoantibodies to La (SS-B)	36	–
ANA (antinuclear antibody) positivity	37	–
RF (rheuma factor) positivity	29	–
ANCA (antineutrophilic cytoplasma antibody) positivity	1	–
ENA (antibody against extractible nuclear antigen) positivity	43	–
AMA (antimitochondrial antibody) positivity	2	–
Arthralgia	23	–
Polyarthritis	24	–
Gastrointestinal symptoms[a]	6	–
Pseudolymphoma	1	–
Autoimmune hepatitis	4	–
Colitis[b]	5	–
Autoimmune thyroid disease[c]	4	–
Neuropathia	1	–
Hypertonia	9	–
Cardial symptoms[d]	4	–
Vasculitis	4	–
Focal myositis	1	–
Smokers (No)	3	2
Removable denture wearers	26	13

anti-ENA antigen antibodies: anti-U1 ribonucleoprotein (RNP), antinuclear ribonucleoprotein (nRNP), anti-Sm (Smith), anti-Ro (SSA) and anti-Ro (SSB).
[a]Gastrointestinal symptoms: duodenitis: 2, atrophic gastritis: 1, ulcus ventriculi: 1, hyperacid gastritis:1, gastroesophageal reflux disease:1.
[b]Colitis: irritable colon syndrome: 3, erosive proctitis: 1, colitis ulcerosa: 1.
[c]Thyroid disease: benign thyroid tumor 1, Basedow-Graves disease: 1, hypotyreosis 1, Hashimoto thyreoiditis: 1.
[d]Cardial symptoms: cardial decompensation: 1, angina pectoris: 1, arrhythmia: 2.

labial salivary glands was performed by the method of Daniels (1984). The histopathologic diagnosis was based on 'focus scoring' in which a focus was defined as an aggregate of at least 50 lymphocytes per 4 mm^2 of glandular tissue a focus score of ≥1 was considered to be positive (Daniels, 1984).

The preparations of SS-A and SS-B antigens were patterned after the method of Lieu *et al* (1984). Anti-SS-A and anti-SS-B antibodies and all other types of antibodies in the serum of SS patients were identified by the ELISA technique (Autostart II; Hycore, Garden Grove, CA, USA).

The orofacial conditions of 43 randomly selected age- and sex-matched healthy controls from the urban and rural areas of northeastern Hungary (39 women and four men) were also examined at the Hajdú-Bihar County Dental Service. Control persons came for regular control or dental treatment to the office.

All persons taking part in this study were asked, through the use of a standardized questionnaire, about their general, oral, ocular and denture-related complaints, including questions about the possible characteristic sicca symptoms (dryness of the eyes and mouth, dysphagia, burning mouth and tongue (glossodynia), tracheal symptoms (unproductive dry cough or dysphonia)). The questionnaire was based, in part, on questions of the 'European classification criteria for SS' with a 'Yes or No' outcome (Vitali *et al*, 2002).

This study was approved by the Regional Ethical Committee and each person gave a written consent to the study.

Assessment of unstimulated whole saliva flow rate and palatal saliva flow rate

The flow rate of unstimulated WS was determined in every person according to the method described by Sreebny *et al* (1992). A secretion rate of ≤0.1 ml min^{-1} was considered abnormally low.

Palatal saliva flow rate was measured with the aid of filter paper disks (Rundfilter MN 640d; Macherey-Nagel & Co., Düren, Germany.) The technique was standardized and validated with known amounts of water and mixed saliva. Dry, previously weighed disks with a diameter of 8 mm (0.5 cm^2) were individually placed on both sides of the palate, in the region of the upper first molars, 15 mm palatally from the gingival margin. Before the placement of the disks, the palate was completely, but gently dried with a piece of gauze, and was completely isolated with cotton wool rolls to avoid moisture from the parotid gland. The collection was carried out for 30 s. The disks were stored in closed, preweighed Eppendorf tubes and then weighed by using an electronic scale (Sartorius BA 110 S; Sartorius, Goettingen Germany). The data were recorded as $\mu l\ min^{-1}\ cm^{-2}$ (Hamada *et al*, 1974).

Oral mucosal changes

Visual evaluation of the oral mucosa was carried out for the detection of soft tissue alterations (atrophy, ulceration, signs of candidiasis, denture stomatitis, teleangiectasia, etc.) according to a standard procedure (Langlais *et al*, 1984).

Dental and periodontal examinations

The number of decayed, missing and filled teeth (DMF-T number) was determined by the use of a standard dental mirror and probe (World Health Organization, 1997). Mean values and the standard deviations (s.d.) were calculated.

The periodontal probing depth (PPD) was determined with a calibrated periodontal probe and was defined as the distance between the free gingival margin and the base of the pocket in mm. The PPD was measured at six surfaces of each tooth (Nyman and Lindhe, 1983). The number of sites with a PPD ≥5 mm was also recorded. Evidence of bleeding during the probing test was determined by the Ainamo–Bay gingival bleeding index (GBI). Four surfaces were examined around each tooth and the data were recorded as a percentage of the surfaces that were examined (Ainamo and Bay, 1975).

The presence and status of maxillary and/or mandibular, complete or partial dentures were recorded for each patient.

Statistical analysis

All records were expressed as mean ± s.d. Data were analyzed statistically by using SPSS 11.0 for Windows

software program (SPSS Inc., Chicago, IL, USA). Unpaired Student's *t*-test was used for analyzing WS, PS, DMF-T and PPD, and chi-squared test was employed for analyzing the difference between the number of patients and controls with xerostomia, dryness of the eyes, dysphagia, tracheal complains, and oral mucosal findings. For multiple comparisons of PS in SS subgroups, analysis of variance (ANOVA) was used. $P < 0.05$ was considered statistically significant.

Results

Medical findings

The clinical profile of the patients is presented in Table 2. The medical findings were consistent with those associated with SS patients; 94% of them were females. Keratoconjunctivitis sicca (positive Schirmer's test and TBUT), as a sign of decline in the tear production, was found in 49 SS patients. Twenty-six of them suffered from intermittent swelling of the salivary glands; arthralgia was present in 95% of the patients. Autoantibody tests revealed the presence of SS-A in 41 and SS-B in 36 of the 49 patients. Positive, minor salivary gland focus scores were found in 73% (36/49) of the SS patients. Three patients and two controls were smokers.

Subjective symptoms

According to the answers given to the questionnaire, 45 of the 49 patients (92%) and five of the 43 controls (12%) complained of dry mouth, and 47 of the 49 patients (95%) complained of dryness of the eyes. Nine patients and one control suffered from halitosis. Fatigue and pain of the tongue (glossodynia) were mentioned by 19 patients. Out of those 19, 13 wore removable dentures. Seventeen patients had dysphagia while seven patients had tracheal complaints (Table 3).

Major and minor salivary gland function

The whole resting saliva flow rate (WS) was 0.12 ± 0.13 ml min^{-1} in the patient group. This was significantly lower ($P < 0.001$ by the Student's *t*-test) than in the controls, where it was 0.37 ± 0.24 ml min^{-1}. The PS flow rate was not different between the two groups. Even those patients who complained of xerostomia or glossodynia, or who demonstrated signs of denture stomatitis or decreased WS flow rate, had PS flow rates which were within the 'normal' range (Table 4).

Table 3 Subjective symptoms of 49 patients with Sjögren's syndrome compared with 43 healthy controls

	Patients	*Controls*
Tracheal complaints	7*	0
Dysphagia	17*	0
Xerostomia	45**	5
Dryness of the eyes	47**	0
Glossodynia	19* (13 were removable denture wearers)	0

*$P < 0.01$; **$P < 0.001$ by the chi-squared test.

Table 4 Palatal saliva (PS) flow rate in relation to different symptoms in patients with Sjögren's syndrome (SS) and in controls

	PS flow rate ($\mu l\ cm^{-2}\ min^{-1}$)
43 controls	1.35 ± 2.5
49 patients with SS	1.57 ± 1.02
SS with oral symptoms	
Without symptoms (16)	1.78 ± 1.50
Mucosal signs of candidiasis (17)	1.45 ± 0.95
Glossodynia (19)	1.32 ± 0.57
SS with subjective xerostomia	
Present (45)	1.54 ± 1.01
No complaints (4)	1.75 ± 0.98
SS with WS $\leq$0.1 ml min^{-1} (hyposalivation)	
Present (33)	1.70 ± 1.14
Normal flow rate (16)	1.38 ± 0.83

No significant difference in PS in any kind of symptoms by the Student's *t*-test. WS, whole saliva.

Oral mucosal lesions

The clinical examination of the patients revealed moderate changes in the oral mucosa, but some alterations were detected in the healthy controls as well (Table 5). Fourteen patients and two controls demonstrated signs of erythematous lesions on their palate. The difference was significant ($P < 0.05$ by the chi-squared test). Ten patients and the two controls among these persons wore removable dentures. A remarkable observation was the significantly higher number of fissured tongue in SS patients compared with the controls (20 and 2, respectively; $P < 0.01$ by the chi-squared test). Seventeen patients who complained of glossodynia and/or showed lingual atrophy also showed mucosal alterations characteristic of oral candidiasis: denture stomatitis in nine, atrophic oral mucosa in four, cheilitis angularis in two, and erythematous lesions of the palate in eight cases.

Dental and periodontal examinations

The DMF-T score in the patient group was significantly higher ($P < 0.05$ by the Student's *t*-test) (mean: 27.1 ± 6.12) than that in the control group (mean: 23.0 ± 6.99). Neither the *D* score (number of decayed teeth) (mean: 1.83 ± 4.44 in the patient group; 2.3 ± 2.8 in the control group) nor the *F* (number of filled teeth) score (mean: 4.87 ± 5.04 in patients; 5.12 ± 4.73 in controls) showed significant difference between the two groups. However, the *M* score (number of missing teeth) was statistically significantly higher in the patients ($P < 0.05$ by the Student's *t*-test) (mean: 20.3 ± 9.46) than in the controls (mean: 15.7 ± 10.3). An assessment of the components of the DMF-T scores (*D*, *M*, and *F*) demonstrated that the DMF-T number was significantly higher in those patients who had both abnormal focus scores and antibody positivity, than in those with only one of these parameters positive (mean:

Table 5 Oral symptoms and mucosal findings in patients with Sjögren's syndrome compared with controls

	Patients (49)	*Controls (43)*
Atrophy of the oral mucosa	5	1
Angular cheilitis	1	2
Erythematous lesions on the palate	14 (10 denture stomatitis out of 26 denture wearers)*	2 (2 denture stomatitis out of 13 denture wearers)
Fissuration of the tongue	20**	2
Atrophy and slight reddening of the lingual mucosa	17**	4
Black hairy tongue (lingua pilosa nigra)	8 (1 smoker)	2
Median rhomboid glossitis	3	5
Geographic tongue	1	2
Whole resting saliva flow rate ≤1 ml min^{-1}	33***	4
Sialoadenitis (swollen salivary gland)	26***	0
Keratoconjunctivitis sicca (positive Schirmer's test)	49***	0
Unstable dentures	0	0

*$P < 0.05$; **$P < 0.01$; ***$P < 0.001$ by the chi-squared test.

Table 6 Gingival and periodontal condition of patients with Sjögren's syndrome (SS) and controls

	SS ($n = 38$)[a]	*Controls* ($n = 34$)[a]
PPD (mm)	2.28 ± 1.09*	1.82 ± 0.73
PPD ≥5 mm (no. patients	14	14
PPD ≥5 mm (average no. sites/person)	1.6 ± 3 (0–12)	1.31 ± 1.99 (0–7)
Gingival Bleeding (Ainamo–Bay) Index (%)	20.09 ± 23.56*	10.54 ± 11.57

PPD, periodontal probing depth.
[a]Complete denture wearers on both jaws were excluded.
*$P < 0.05$ by the Student's *t*-test.

30.3 ± 4.6 ($n = 9$) and 26.5 ± 6.77 ($n = 29$), respectively; $P < 0.05$ by the Student's *t*-test).

Table 6 shows the values of the PPD and the GBI values in the patient and the healthy control groups. The PPD was increased in the patient group (mean: 2.28 ± 1.09 mm) compared with the control group (mean: 1.82 ± 0.73 mm) ($P < 0.05$). Moreover, it was higher in the patients who had anti-SSA and/or anti-SSB positivity (mean: 3.06 ± 1.1 and 2.04 ± 0.98 $P < 0.01$ by the Student's *t*-test) or antinuclear antibody positivity ($P < 0.05$ by the Student's *t*-test), but there was no correlation with the focus score positivity. Likewise, no correlation was found between WS flow rate and the periodontal parameters.

The mean GBI was 20 ± 23.5% for the SS patients. This was twice that observed among the controls (10.5 ± 11.5%). The difference was statistically significant ($P < 0.05$ by the Student's *t*-test).

Eleven persons in the patient group (24.5%) and nine persons in the control group (20.9%) wore complete dentures in both jaws. Seven patients (14.2%) and three controls (6.97%) were edentulous in one jaw. Eight patients (16.3%) and one control (2.32%) wore removable partial dentures; the dentures of six of these patients and one of the controls were made of acrylic. Seventeen patients and 11 controls had only fixed restorations. The average wearing period of the prosthetic appliances was 5 years, both in the patient and the control groups. None of the patients complained about instability of the removable dentures; two of them did not wear them due to discomfort.

Discussion

One of the hallmarks of SS is the presence of oral dryness. This is generally associated with a significant decrease in the flow rate of WS. No one, to our knowledge, has estimated the contribution of PS to xerostomia and the thickness of the salivary film, which is present on the surface of the hard palate. Our findings indicate that there is no significant difference between the flow rates of PS between the SS patients and the healthy, normal subjects. Although palatal film was not assessed in our study, these data suggest that the mixed, WS, rather than the viscous, PS is the determinant of the palatal film and the desiccation. This result is in accord with the data of Lee *et al* (2002) who showed that mucosal wetness and the subjective feeling of xerostomia might be associated with unstimulated WS and not with PS flow rate and the function of the palatal salivary glands relatively well preserved in patients with dry mouth. It should be noted that medication might also influence saliva flow rate, but this factor is an integral part of the clinical appearance of this disease.

The high number of SS patients suffering from glossodynia might be the result of symptomatic xerostomia (every patient with glossodynia, except one, suffered from xerostomia as well). However, denture wearing might also be an important cause of glossodynia, as two-thirds of the SS patients were removable denture wearers. The screening of oral mucosal status revealed erythematous lesions of the palate as a frequent alteration compared with the controls. It is likely to be a sign of oral fungal infection. Most of the patients and the two controls demonstrating the lesions wore removable dentures, indicating that denture wearing could be the main reason for this. The most frequently detectable oral mucosal alteration among the SS patients was fissured tongue (40%), but two of the controls (4%)

showed this sign, also. Lingual atrophy and slight reddening was also a remarkable finding in patients with SS. According to the results of the present study, both these lingual alterations (atrophy and fissuring) are characteristic signs of oral mucosal desiccation, as also suggested by Sreebny (1990). It must be noted however that *Candida* infection might also be a cause of the burning tongue in SS patients. In a recent study (Kurnatowska, 2001) a connection was found in 81% of the cases between burning mouth syndrome and candidiasis. Another study showed that in almost 33% of the patients suffering from glossodynia, candidiasis could be detected without any objective manifestation on the oral mucosa (Osaki *et al*, 2000). In our SS patients, 50% of those who manifested angular cheilitis or erythematous lesions on their oral mucosa suffered from glossodynia as well.

Our study demonstrated significantly higher DMF-T scores in SS patients compared with the controls. These findings are in agreement with previous investigations (Baudet-Pommel *et al*, 1994; Pedersen *et al*, 1999). Our findings, as well as those of Pedersen *et al* (1999) show that it is primarily the *M* score, namely the index of missing teeth, that caused the DMF-T increase. Furthermore it has been demonstrated that the PPD index was significantly higher in SS patients than in healthy controls (Najera *et al*, 1997; Pedersen *et al*, 1999; Celenligil *et al*, 1998). In the patient group of Celenligil *et al* (2002), PPD was in positive correlation with anti-SSA and/or anti-SSB positivity. Our results were similar to this. No differences, on the other hand, were observed in the severity of periodontal disease between patients and controls. This was due to the fact that the number of the periodontal pockets deeper than 5 mm/person was similar. It has been shown that there is no correlation between the WS flow rate and the periodontal status in healthy people (Crow and Ship, 1995). We suggest that the dental and periodontal conditions of the SS patients are related to the autoimmune process as well, and not only to the flow rate of WS, although it must be noted that the investigator completing the clinical examination was not blinded to the diagnosis of the patient *vs* controls.

In conclusion, a novel finding in this study was the fact that the flow rate of the normally viscous PS was not decreased in SS. The palatal film is a sensitive indicator of oral dryness. Our data suggest that the reduction in film thickness is associated with a decrease in the flow of WS, but not PS. Although it should be noted that it is a dichotomous outcome for patients with only SS (as 92% of them were xerostomic), its general importance in other xerostomic persons needs further examination.

People with SS have a higher risk of loosing their teeth due to their low whole, unstimulated saliva flow rate and to the negative effects of the autoimmune process. The Hungarian SS patients in this study complained of and exhibited widespread signs of desiccation: most of them suffered from xerostomia and dry eyes. Halitosis, glossodynia, and dysphagia were also characteristic complaints among the xerostomic subjects. Almost every SS patient demonstrated keratoconjunctivitis sicca as well as a substantial decrease in the flow rate of their WS as reasonable causes of their desiccation. Remarkable signs of the dry oral mucosa were erythematous lesions of the palate and fissured tongue. They evidenced a marked decline in their dental, gingival and periodontal health.

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